LAW OFFICES
LEYDIG, VOIT & MAYER, LTD.
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, ILLINOIS 60601-6780

TELEPHONE: (312) 616-5600
FACSIMILE: (312) 616-5700 (G3)
(312) 849-0495 (G4)

FACSIMILE COVER SHEET

DATE: MARCH 27, 2007

NUMBER OF PAGES (INCLUDING THIS TRANSMITTAL COVER SHEET): 100

OUR REFERENCE: 210030

FROM: DAVID C. ANNIS
REGISTRATION NO. 54,963

DIRECT LINE: (312) 616-5600

TO: UNITED STATES PATENT AND TRADEMARK OFFICE
ATTN: HENRY YUEN
ALEXANDRIA, VA 22313

FACSIMILE NUMBER: (571) 273-4856

IN RE APPLN. OF: WU
APPLICATION NO. 09/891,576
FILED: JUNE 25, 2001
DOCKET NO.: 210030

PER YOUR VOICE MAIL MESSAGE OF MARCH 23, 2007, PLEASE FIND ATTACHED THE COMMUNICATIONS TO AND FROM THE UNITED STATES PATENT AND TRADEMARK OFFICE DATED JUNE 25, 2001 THROUGH SEPTEMBER 7, 2005 (99 PAGES).

PLEASE CONFIRM SAFE RECEIPT BY RETURN FACSIMILE OR VIA TELEPHONE TO THE ABOVE-NAMED ATTORNEY.

A confirmation copy of the transmitted document will:
☒ Not be sent. This will be the only form of delivery of the transmitted document.

FaxPTO (2/2006)

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	210030
First Inventor	Nanping WU
Title	PLATE FREEZER EVAPORATOR WITH CARBON DIOXIDE REFRIGERANT
Express Mail Label No.	EL643484072US

APPLICATION ELEMENTS

1. ☒ Utility Patent Application Transmittal Form
2. ☐ Applicant claims small entity status. See 37 CFR 1.27.
3. ☒ Specification (including claims and abstract) [Total Pages 26]
4. ☒ Drawings [Total Sheets 8]
5. ☒ Combined Declaration and Power of Attorney [Total Pages 3]
   a. ☒ Newly executed
   b. ☐ Copy from prior application [Note Box 6 below]
      i. ☐ Deletion of Inventor(s) Signed statement attached deleting inventor(s) named in the prior application
6. ☐ Incorporation by Reference: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b is considered as part of the disclosure of the accompanying application and is hereby incorporated by reference.
7. ☒ Application Data Sheet. See 37 CFR 1.76
8. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
9. Nucleotide and/or Amino Acid Sequence Submission
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper Copy
   c. ☐ Statement verifying identity of above copies

ADDRESS TO: Commissioner for Patents, Box Patent Application, Washington, DC 20231

ACCOMPANYING APPLICATION PARTS

10. ☐ Applicant requests early publication. (include publication fee under 37 CFR 1.18(d))
11. ☐ Assignment Papers (cover sheet and document(s))
12. ☐ 37 CFR 3.73(b) Statement (when there is an Assignee)
13. ☐ Power of Attorney
14. ☐ English Translation Document (if applicable)
15. ☐ Information Disclosure Statement (IDS)
    ☐ Form PTO-1449
    ☐ Copies of Listed Documents
16. ☐ Preliminary Amendment
17. ☒ Return Receipt Postcard (Should be specifically itemized)
18. ☐ Claim of Priority & Certified Copy of Priority Document(s)
19. ☐ Request & Certification Under 35 USC 122(b)(2)(B)(i) (Form PTO/SB/35 or its equivalent must be submitted with this application to prevent publication at 18 months)
20. ☐ Other:

21. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information below:
    ☐ Continuation ☐ Divisional ☐ Continuation-in-part of prior application no.
    Prior application information: Examiner ; Group Art Unit:

APPLICATION FEES

BASIC FEE				$710.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total Claims	40 -20=	20	x $18.00	$360.00
Independent Claims	3 - 3=	0	x $80.00	$0.00
☐ Multiple Dependent Claim if applicable			+$270.00	$0.00
		Total of above calculations =		$1,070.00
		Reduction by 50% for filing by small entity =		$(0.00)
☐ Assignment fee if applicable			+ $40.00	$0.00
☐ Early publication fee if applicable			+ $300.00	$0.00
			TOTAL =	$1,070.00

RECEIVED
CENTRAL FAX CENTER
MAR 27 2007

UTILITY PATENT APPLICATION TRANSMITTAL | Attorney Docket No. 210030

22. ☐ Please charge my Deposit Account No. 12-1216 in the amount of $

23. ☒ A check in the amount of $1,070.00 is enclosed.

24. The Commissioner is hereby authorized to credit overpayments or charge any additional fees of the following types to Deposit Account No. 12-1216:
   a. ☒ Fees required under 37 CFR 1.16.
   b. ☒ Fees required under 37 CFR 1.17.

25. ☒ The Commissioner is hereby generally authorized under 37 CFR 1.136(a)(3) to treat any future reply in this or any related application filed pursuant to 37 CFR 1.53 requiring an extension of time as incorporating a request therefor, and the Commissioner is hereby specifically authorized to charge Deposit Account No. 12-1216 for any fee that may be due in connection with such a request for an extension of time.

26. CORRESPONDENCE ADDRESS

☒ Customer Number: 23460	☐ , Reg. No.
23460 PATENT TRADEMARK OFFICE	Leydig, Voit & Mayer, Ltd. Two Prudential Plaza, Suite 4900 180 North Stetson Chicago, Illinois 60601-6780 (312) 616-5600 (telephone) (312) 616-5700 (facsimile)

Name	Jamison E. Lynch, Registration No. 41168
Signature	Jamison E. Lynch REG. NO. 41,168
Date	June 25, 2001

Certificate of Mailing Under 37 CFR 1.10

I hereby certify that this Utility Patent Application Transmittal and all accompanying documents are being deposited with the United States Postal Service "Express Mail Post Office To Addressee" Service under 37 CFR 1.10 on the date indicated below and is addressed to: Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.

VERONICA MEIERD		June 25, 2001
Name of Person Signing	Signature	Date

Utility (Rev. 04/26/2001)

PLATE FREEZER EVAPORATOR WITH CARBON DIOXIDE REFRIGERANT

FIELD OF THE INVENTION

[0001] The present invention generally relates to plate freezers, and more particularly, the invention relates to an improved design of a plate freezer evaporator for accommodating increased refrigerant pressures associated with the use of carbon dioxide as a refrigerant.

BACKGROUND OF THE INVENTION

[0002] Plate freezers are generally known in the art. They are high efficiency freezers used in a variety of applications, usually in the food processing industry. Typically, one or more spaced-apart heat-exchanger plates are located in the freezer compartment. A refrigerant passes through each of the plates to lower the temperature of the plates and the freezer compartment. The items to be frozen are then placed on the refrigerated plates. The high efficiency of plate freezers allow for a reduction in the size of the freezer compartment and for a more rapid freezing than in typical cold air freezers where the cold air is simply blown over the items until frozen.

[0003] One commonly used thermodynamic cycle for plate freezer applications is known as a vapor-compression refrigeration cycle. In this cycle, a superheated vapor refrigerant is compressed in a compressor, causing an increase in temperature. The hot, high pressure refrigerant is then circulated through a heat exchanger, called a condenser, where it is cooled by heat transfer to the surrounding environment. As a result of the heat transfer to the environment, the refrigerant condenses from a gas to a liquid. After leaving the condenser, the refrigerant passes through a throttling device where the pressure and temperature both are reduced. Upon exiting the throttling

device, the refrigerant enters a second heat exchanger, called an evaporator, located in the freezer space. In plate freezers, the evaporator includes a plate surface upon which the items to be frozen are placed. Heat transfer in the evaporator causes the refrigerant to change from a liquid phase to a saturated mixture of liquid and vapor. The vapor leaving the evaporator is then drawn back into the compressor, and the cycle is repeated.

[0004] In recent years, concern for the environment has brought about a phase-out of many refrigerants traditionally used in vapor-compression refrigeration systems. This phase-out of traditional refrigerants, such as chlorofluorocarbons ("CFCs"), occurred since their release into the environment depleted the ozone layer in the stratosphere. The use and emission of these refrigerants are now regulated through the terms of the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer. The 1987 Montreal Protocol places stringent limitations on the use of CFC refrigerants. As such, there has been an immediate shift away from CFCs toward refrigerants that are more environmentally friendly.

[0005] The effort to find thermodynamically suitable refrigerants that do not adversely affect the ozone layer has led to the use of ammonia (NH_3) and carbon dioxide (CO_2) as refrigerants. These refrigerants have virtually no ozone depletion potential. Despite its environmental appeal as a refrigerant, ammonia (NH_3) has a pungent, suffocating odor and is toxic and flammable under certain conditions.

[0006] The use of carbon dioxide as a refrigerant also has certain drawbacks. One difficulty associated with the use of carbon dioxide as a refrigerant is the high working pressure of the carbon dioxide. In typical plate freezer applications, the working pressure of the carbon dioxide ranges from approximately 100 psig (690 kPa) to

about 300 psig (2070 kPa). The required refrigerant pressure associated with the use of carbon dioxide can create unacceptable stress levels in the components of a plate freezer.

[0007] An additional difficulty associated with the use of carbon dioxide is the pressure increase associated with a "shut-down" of the freezer. Freezer shut-down can occur through an interruption in the source of electrical power as well as the intentional shut-down of the freezer for defrosting or servicing. In the event that a freezer shut-down causes the carbon dioxide to reach room temperature, the refrigerant can reach pressures in excess of 1000 psig (6900 kPa). The pressure increase has been addressed through the use of a system of relief valves, such as those shown generally in United States Patent Nos. 4,986,086 and 5,042,262. However, the use of a relief valve system requires refilling of the refrigeration system with refrigerant lost through the relief valve before the freezer can be restarted.

[0008] Accordingly, it would be desirable to have an evaporator for use in a vapor-compression refrigeration cycle which uses carbon dioxide as a refrigerant. Furthermore, it would be desirable to accommodate increased working pressure when using a carbon dioxide refrigerant, as well as the increased in carbon dioxide pressure during shut-down without loss of refrigerant while maintaining stress levels in the evaporator substantially below the yield strength of the material from which the evaporator is constructed.

SUMMARY OF THE INVENTION

[0009] Accordingly, it is a general object of the invention to overcome the deficiencies of the prior art.

[00010] It is a more specific object of the present invention to provide an improved evaporator for use in a vapor-compression refrigeration cycle.

[00011] It is a further object of the present invention to provide an evaporator for use in a plate freezer in which carbon dioxide is used as the refrigerant.

[00012] It is another object of the present invention to address high refrigerant pressures associated with freezer shut-down without loss of refrigerant.

[00013] The present invention provides these and other additional objects with a plate freezer evaporator which uses carbon dioxide as a refrigerant. The evaporator is adapted to accommodate refrigerant pressures associated with ordinary freezer operation as well as the elevated refrigerant pressures, such as those encountered during freezer shut-down. The evaporator includes a longitudinally extending plate body having a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to define a plate body solid volume. The evaporator also includes at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant (such as carbon dioxide) maintained at a relatively high pressure. The duct has an elliptical cross-section designed to maintain a stress level in the plate body at a level substantially below the yield strength of the material from which the plate body is constructed.. By forming the duct in this fashion, the evaporator accommodates refrigerant pressures associated with ordinary freezer operation as well as the elevated refrigerant pressures, such as those encountered during freezer shut-down.

[00014] Other objects and advantages will become apparent upon reading the following detailed description and upon reference to the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[00015] Fig. 1 is a perspective view of two plate freezer shelves which are comprised of a plurality of individual freezer plates;

[00016] Fig. 2 is a partially-exploded perspective view of one of the plate freezer shelves shown in Fig. 1;

[00017] Fig. 3 is a partial cut-away enlargement of a portion of Fig. 2 illustrating a refrigerant flow path;

[00018] Fig. 4 is a cross-sectional view of a freezer plate along line 4-4 in Fig. 2;

[00019] Fig. 5 is a cross-sectional view of a header along line 5-5 in Fig. 2;

[00020] Fig.6 is a cross-sectional view of a freezer plate along line 4-4 in Fig. 2 showing the displacement of the freezer plate when the internal pressure in the plate is approximately 1400 psig (9660 kPa);

[00021] Fig.7 is a cross-sectional view of a header along line 5-5 in Fig. 2 showing the displacement of the header when the internal pressure in the header is approximately 1400 psig (9660 kPa); and

[00022] Fig. 8 is a diagrammatic illustration of a mechanical refrigeration system for use in conjunction with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00023] Generally, the present invention relates to a plate freezer evaporator, having a duct with an elliptical cross section, located between two heat exchanger surfaces which define a generally solid plate body with the elliptical duct present in each plate body. The shape of the duct allows the evaporator to accommodate carbon dioxide pressures associated with ordinary freezer operation as well

as the elevated refrigerant pressures encountered during freezer shut-down. Although described in the context of a plate freezer utilizing carbon dioxide as a refrigerant, it should be understood that the invention is not limited to such applications. The invention may be used in other refrigeration or heat transfer applications which utilize a variety of working fluids in lieu of or in addition to carbon dioxide.

[00024] Fig. 1 is a perspective view of two freezer shelves and spaced apart from one another. Each freezer shelf is adapted to receive items to be frozen between the adjacent shelves. Each of the shelves comprises of a plurality of generally rectangular freezer plates 20. Each freezer plate 20 has a length that is substantially greater than the width. Adjoining freezer plates are placed adjacent to one another along their respective lengths and attached to one another in this side-by-side orientation to create a plate freezer shelf as shown in Figs 1 and 2. The resulting plate freezer shelf is then connected to an inlet header 32 and an outlet header 34.

[00025] During ordinary operation of a plate freezer, carbon dioxide is pumped into the freezer plates 20 from the liquid manifold 28 through one of the several inlet hoses 30. The carbon dioxide then flows through a serpentine circulation duct (reference numeral 50 in Figs. 2, 3, 4 and 6) located in each of the freezer plates 20. After the carbon dioxide has passed through the entire length of the circulation duct located in each freezer plate 20, it flows into the outlet headers 34.

[00026] Due to heat transfer to the carbon dioxide from the items located on the plate freezer to be frozen, the carbon dioxide exits the outlet headers 34 as a saturated mixture of liquid and vapor. This saturated mixture enters the collecting manifold 38 through one of the

outlet hoses 36 leading from the outlet headers 34 to the collecting manifold 38. The saturated mixture of liquid and vapor carbon dioxide then exits the collecting manifold 38 towards the primary receiver 24 shown by flow arrow 26c in Fig. 8.

[00027] A plurality of freezer plates 20 are attached to one another and are positioned in spaced-apart relation to create a plurality of plate freezer shelves. The plurality of freezer plates 20 which comprise a plate freezer shelf are located within the sealed freezer space. The items to be frozen are placed on a freezer plate shelf. Although Fig. 1 illustrates the plate freezer shelf as being comprised of thirteen individual freezer plates 20, any number of freezer plates 20 can be used to create a freezer plate shelf of the desired size. Additionally, a plurality of freezer plate shelves can be located in a particular freezer space to maximize the number of items which a given freezer volume can accommodate for freezing.

[00028] Fig. 2 is a partially-exploded perspective view of the freezer plates 20 assembled to form a single plate freezer shelf. Fig. 2 illustrates the circulation of the carbon dioxide from the inlet header 32, through the freezer plates 20 and into the outlet header 34.

[00029] In Fig. 2, the carbon dioxide enters the inlet header 32 through the inlet hose 30. Located in the inlet header 32 is a plurality of inlet header apertures 48. Each inlet header aperture 48 is in fluid communication with a serpentine circulation duct 50 located within each freezer plate 20. The fluid communication between the apertures 48 and the circulation duct 50 allows carbon dioxide to flow from the inlet header 32 into the freezer plate 20. Shown in Fig. 2, each individual freezer plate 20 has a single serpentine circulation duct 50 with each duct having a single inlet 52 and a single outlet 56 with each inlet 52 in

fluid communication with an inlet header aperture 48. The serpentine-shaped circulation duct 50 allows carbon dioxide to flow through the freezer plate 20 while having sufficient residence time within the freezer plate to allow heat transfer to occur and cool the freezer plate 20.

[00030] Although Fig. 2 illustrates each freezer plate 20 as having a single serpentine circulation duct 50 with a single inlet 52 and outlet 56, it will be appreciated by those of skill in the relevant art that each freezer plate 20 may have multiple serpentine ducts 50 and may also have multiple inlets and outlets and still be within the scope of the present invention.

[00031] Upon flowing through the entire length of the circulation duct 50, the carbon dioxide exits the freezer plate 20 and enters the outlet header 34. The outlet header 34 contains a plurality of outlet header apertures 54 which are in fluid communication with a circulation duct outlet 56 such that the carbon dioxide can flow from the circulation duct 50 into the outlet header 34 through the outlet header apertures 54. The carbon dioxide then flows the length of the outlet header 34 and exits through the outlet hose 36 into the collecting manifold 38 shown in Figs. 1 and 8.

[00032] Fig. 3 is a partial cut-away enlargement of a portion of Fig. 2 illustrating a flow path of carbon dioxide from the inlet hose 30, through the inlet header 32 and into the freezer plate 20. In particular, the carbon dioxide enters the inlet header 32 through the inlet hose 30 from the liquid manifold 28 (shown in Figs. 1 and 8). The carbon dioxide enters the first channel 58 of the inlet header 32 and flows through a series of apertures 60 in the web 62 which separates the first channel 58 from the second channel 64 of the inlet header 32. Upon entering the second channel 64 of the inlet header 32, the carbon dioxide flows through the inlet header aperture 48 and into the freezer plate 20

through a circulation duct inlet 52. The direction of flow of the carbon dioxide from the inlet header 32 into the freezer plate 20 is indicated by the arrow 66.

[00033] Although Fig. 3 illustrates the inlet header 32 separated from the freezer plate 20, this is merely for illustrative purposes to show the carbon dioxide flow from the inlet header 32 into the freezer plate 20. In practice, the inlet and outlet headers 32, 34 will be securely fastened to the freezer plates 20 by welding or other suitable means to prevent carbon dioxide leakage between the inlet header 32 and an individual freezer plate 20.

[00034] The carbon dioxide enters the freezer plate 20 through the circulation duct 50. The circulation duct 50 is shown in Figs. 2, 3, 4 and 8 to have an approximately elliptical cross-sectional shape. The cross-sectional design of the circulation duct 50 of the present invention eliminates corners which are present in rectangular ducts and act as discrete regions of unacceptably high stress when carbon dioxide is used as a refrigerant. With the use of the cross-sectional shape of the present invention, the stress concentration factor is significantly reduced from the level encountered with the use of prior circulation ducts. The presence of elliptical ducts allows the present invention to safely operate with carbon dioxide as a refrigerant. Additionally, the use of nearly elliptical circulation ducts significantly reduces the amount of outward displacement experienced by the mid-point of the circulation duct during the elevated internal pressures associated with the use of carbon dioxide.

[00035] Upon entering the freezer plate 20, the carbon dioxide flows through the serpentine circulation duct 50 as shown by the arrows 68 in Fig. 3. When the first end of the circulation duct 50, located towards the outlet end of the freezer plate, is encountered by the carbon dioxide,

the serpentine shape effects a 180 degree turn in the carbon dioxide and directs it back towards the inlet header 32. When the carbon dioxide reaches the inlet header 32 it then crosses over through another 180 degree turn to the next elliptical duct, as shown by the arrows 70, to flow back towards the outlet header. This serpentine flow is repeated numerous times, preferably seven with six 180 degree turns, although only a single 180 degree turn is illustrated in Fig. 3.

[00036] Because the operating pressure of the carbon dioxide is higher than that of ammonia (NH_3), the headers 32,34 must be sufficiently robust to withstand the increased operating pressure as well as the elevated pressures encountered when the refrigeration system is powered down. For example, placing the web 62 between the first and second channels 58, 64 increases the structural integrity of the headers 32, 34 so that the headers can safely handle the elevated pressures associated with the use of carbon dioxide as the refrigerant.

[00037] Although only one pass of the carbon dioxide through the freezer plate is illustrated in Fig. 3, a person of skill in the relevant art would understand that multiple passes would be desirable to enhance the overall freezer efficiency. In the preferred mode of operation, the refrigerant makes seven parallel passes with six 180 degree turns through each freezer plate before exiting the freezer plate 20 and entering the outlet header. The seven preferred passes of the refrigerant through the elliptical serpentine duct 50 includes having the refrigerant flow substantially toward the outlet on four of the passes and substantially towards the inlet on three of the passes thus causing the refrigerant to exit the freezer plate on the opposite end from where it enters as shown in Fig. 2.

[00038] The repeated circulation of the carbon dioxide through the serpentine duct 50 allows the carbon dioxide to absorb heat that has been transferred from the items located on the freezer plate 20 which are to be frozen. Additionally, Fig. 3 illustrates the structures associated with the introduction of carbon dioxide into the freezer plates 20 through the inlet header 32. A substantially similar structure is also present (although not illustrated) on the outlet end of the freezer plates 20.

[00039] Fig. 4 is a cross-sectional view of a freezer plate along line 4-4 shown in Fig. 2. Fig. 4 illustrates the elliptical cross-section of the circulation duct 50 located in each freezer plate 20. Although the cross-section shown in Fig. 4 illustrates only three elliptically shaped ducts 50, any number of ducts, preferably seven, may be located with an individual freezer plate 20.

[00040] The elliptical ducts 50 are formed in the freezer plate 20 which is a solid but for the presence of the ducts 50 passing through the freezer plate 20. The elliptical ducts each have a first diameter 72 and a second diameter 74. The ratio of the first diameter 72 to the second diameter 74 ranges from approximately 2.0 to approximately 2.35, preferably between about 2.1 and about 2.25 and most preferably about 2.21.

[00041] As shown in Fig. 4, as well as Figs. 1, 2, 3 and 6, the freezer plate 20 has a first generally planar heat transfer surface 80 for supporting items to be frozen. The freezer plate 20 also has a second generally planar heat transfer surface 82 spaced apart from the first heat transfer surface 80 to define a solid volume therebetween.

[00042] The freezer plate 20 has a thickness 76 and a width 78. The freezer plate thickness 76 multiplied by the freezer plate width 78 yields the total cross-sectional freezer plate area. Additionally, each ellipse shown as a

cross section of the ducts 50 in Fig. 4 has an area and the sum of the area for all ellipses present in the cross-section of an individual freezer plate is the total ellipse area. The ratio of the total ellipse area to the total cross-sectional freezer plate area ranges from approximately .57 to approximately .67, preferably between about .6 and about .64 and most preferably about .63.

[00043] Due to fundamental thermodynamic differences between ammonia (NH_3) and carbon dioxide (CO_2), including enthalpy and density, the pressure of the carbon dioxide in the freezer plate must be significantly higher to achieve a similar freezing capacity relative to ammonia. This increase in refrigerant pressure combined with prior freezer plate designs placed the peak stress level of the freezer plate at or above the yield strength of aluminum 6061-T6, the material from which freezer plates are preferably constructed. Additionally, the displacement experienced by prior freezer plate designs with the increase in refrigerant pressures, was unacceptable. However, it was not desirable to alter the material from which the freezer plates were constructed due to the favorable thermal conductivity, costs, manufacturing experience and industry acceptance of aluminum freezer plates.

[00044] By creating an elliptical duct 50 in an otherwise solid freezer plate as shown in Fig. 4, the maximum stress level in the freezer plate was dramatically reduced. The reduction in freezer plate stress substantially below the yield strength of aluminum 6061-T6 allowed the use of carbon dioxide as a refrigerant while still allowing for an acceptable factor of safety.

[00045] Moreover, the use of an elliptical duct 50 has yielded another advantage. In a plate freezer, the minimum operating temperature of the carbon dioxide is -50° F (-46° C). This temperature permits the use of inexpensive

carbon steel on some components as well as being sufficiently far away from the triple point of carbon dioxide (-69° F; -56° C) at the working pressure. Because the operating temperature of the carbon dioxide (-50° F; -46° C) is lower than that for ammonia (-40° F; -40° C), the thermal efficiency of a freezer plate using carbon dioxide with elliptical ducts 50 is increased over the use of ammonia and prior freezer plate designs.

[00046] Fig. 5 is a cross-sectional view of a header along line 5-5 shown in Fig. 2. Fig. 5 illustrates the two-channeled header used in conjunction with the carbon dioxide refrigerant. Although shown as a cross-sectional view of the outlet header 34 in Fig. 2, the construction of the inlet header 32 is identical.

[00047] As shown in Fig. 2 and Fig. 5, the carbon dioxide exits a freezer plate 20 through a circulation duct outlet 56 and into the second channel 64 through the outlet header aperture 54. The first channel 64 and the circulation duct outlet 56 are in fluid communication through the outlet header aperture 54 to allow the carbon dioxide to flow from the freezer plate 20 into the outlet header 34. Apertures (identified in Fig. 3 with reference numeral 60) located in the web 62 which separates the first channel 64 from the second channel 58, allow the carbon dioxide to flow from the first channel 64 into the second channel 58. The carbon dioxide then exits the second channel 58 through an outlet hose 36 into the collecting manifold 38 as shown in Figs. 1 and 8.

[00048] With the use of carbon dioxide as a refrigerant and the concomitant increase in refrigerant pressure combined with inadequate prior inlet and outlet header designs, the peak stress levels in the header were above the yield strength of aluminum 6061-T6 from which the headers are preferably constructed.

[00049] However, by designing a more robust header for use with the carbon dioxide refrigerant, including the addition of the web 62, the maximum stress level in each header was dramatically reduced. This reduction in maximum header stress, to a level substantially below the yield strength of aluminum, allowed the use of carbon dioxide as the refrigerant while still maintaining an acceptable factor of safety and minimizing the amount of material required for constructing the headers.

[00050] Fig. 6 is a cross-sectional view of a freezer plate along line 4-4 in Fig. 2 showing the magnified displacement of a freezer plate when the internal pressure in the elliptical ducts is approximately 1400 psig (9660 kPa).

[00051] Fig. 6 is an illustration from a finite element analysis showing the manner in which the elliptical ducts 50 and the first and second heat transfer surfaces 80, 82 of the freezer plate 20 deflect when the internal pressure in the elliptical ducts is approximately 1400 psig (9660 kPa). Based upon this finite element analysis, the areas of the freezer plate cross section with the highest stress and maximum deflection are identified with reference numeral 84 in Fig. 6. The elliptical ducts 50 of the present invention has reduced the magnitude of maximum stress and deflection 84 experienced by the freezer plate at 1400 psig (9660 kPa) by a factor of approximately three.

[00052] The use of the elliptical ducts has placed the maximum stress in the freezer plate 20 at a level substantially below the yield strength of the material from which the freezer plate 20 is typically constructed. With the significant reduction in the maximum stress due to the use of the elliptical ducts 50, the carbon dioxide could be used as a refrigerant without replacing the aluminum 6061-T6. More importantly, using elliptical ducts to reduce the

maximum stress to a level substantially below the yield strength, a factor of safety is now designed into the freezer plate 20.

[00053] Fig. 7 is a cross-sectional view of an outlet header 34 showing the magnified displacement of a freezer plate when the internal pressure within the header is approximately 1400 psig (9660 kPa). Although described in terms of the outlet header 34, the description which follows is equally applicable to the inlet headers 32.

[00054] Fig. 7 is an illustration from a finite element analysis showing the manner in which the first channel 58 and the second channel 64 deflect when the internal pressure in the channels is approximately 1400 psig (9660 kPa). Based upon this finite element analysis, the areas of the header cross section with the highest stress and maximum deflection are identified with reference numeral 86 in Fig. 7. The presence of the web 62 in the header 34 has reduced the region of maximum stress and deflection 86 experienced by the freezer plate when subjected to a refrigerant pressure of approximately 1400 psig (9660 kPa) by a factor of approximately five.

[00055] The use of the two-channel header has placed the maximum stress in the header 34 at a level substantially below the yield strength of the material from which the header 20 is typically constructed. With the significant reduction in the maximum stress due to the use of the two-channel header, the carbon dioxide could be used as a refrigerant without replacing the aluminum 6061-T6. More importantly, using a two-channel header to reduce the maximum stress to a level substantially below the yield strength, a factor of safety is now designed into the header 34.

[00056] Fig. 8 is a diagrammatic illustration of the mechanical refrigeration system 10 for use in conjunction

with the present invention. In operation, a pump 22 draws liquid carbon dioxide from a primary receiver 24 in the direction shown by flow arrows 26a. Liquid carbon dioxide is then discharged from the pump 22 (shown by flow arrows 26b) into the liquid manifold 28. The cold liquid carbon dioxide passes from the liquid manifold 28 into the freezer plates 20 through one of several inlet hoses 30 which connect the liquid manifold 28 with the individual inlet headers 32. The liquid carbon dioxide refrigerant passes through an inlet header 32 and into one of the freezer plates 20.

[00057] The freezer plates 20 are located in the freezer space and the items to be frozen (not illustrated herein) are placed on top of a freezer plate 20 to allow freezing to occur. A plurality of individual freezer plates 20 are placed in side-by-side orientation as shown in Figs. 1 and 2. The freezer plates 20 are then fastened together, usually by welding to produce a freezer plate shelf for supporting the items to be frozen. The individual freezer plates 20 are generally solid aluminum 6061-T6 except for the elliptical duct formed into each freezer plate for circulating the refrigerant. Heat transfer from the items to be frozen through the freezer plates 20 and into the carbon dioxide causes some of the liquid carbon dioxide to evaporate. This evaporation produces a saturated mixture of liquid and vapor carbon dioxide which exits the freezer plates 20 through the outlet headers 34. The saturated mixture of liquid and vapor carbon dioxide then exits the outlet headers 34 through outlet hoses 36 and proceeds into the collecting manifold 38.

[00058] The liquid/vapor carbon dioxide exits the collecting manifold 38 as shown by flow arrow 26c and returns to the primary receiver 24 to repeat the cycle with the liquid portion of liquid/vapor carbon dioxide which has been returned to the primary receiver 24.

[00059] The continuous conversion of a portion of the liquid carbon dioxide present in the primary receiver 24 to gaseous carbon dioxide would eventually convert all of the liquid carbon dioxide to gaseous carbon dioxide and prevent the continued cooling of the freezer plates 20. To replenish the liquid carbon dioxide in the primary receiver 24, the gaseous carbon dioxide located in the primary receiver 24 is pumped from the primary receiver 24 by a compressor 40 in the direction shown by flow arrows 42a in Fig. 8. The super-heated vapor drawn from the primary receiver is then compressed by the compressor 40 causing an increase in pressure and temperature of the carbon dioxide. The hot, high-pressure carbon dioxide is then circulated through a condenser 44 in the direction shown by flow arrow 42b. The carbon dioxide is then cooled through heat transfer to the environment in the condenser 44 to form liquid carbon dioxide which flows from the condenser 44 in the direction shown by flow arrow 42c. The resulting liquid carbon dioxide is then collected in an intermediate receiver 46. The liquid carbon dioxide is then circulated from the intermediate receiver 46 to the primary receiver 24 in the direction shown by flow arrow 42d, thereby, replenishing the liquid carbon dioxide in the primary receiver 24.

[00060] Accordingly, an evaporator for use in a vapor-compression refrigeration cycle meeting the aforestated objectives has been described. It should be understood, however, that the foregoing description has been limited to the presently contemplated best mode for practicing the invention in a specific application using carbon dioxide as a refrigerant. It will be apparent to one of skill in the relevant art that various modifications may be made to the invention, with the attainment of some or all of the advantages of the invention. Accordingly, the invention should only be limited by the appended claims and

equivalents thereof, which claims are intended to cover such other variations and modifications as come within the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. An evaporator adapted for use in a vapor-compression refrigeration cycle in a plate freezer comprising:

a longitudinally extending plate body having a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to define a plate body solid volume; and

at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant, at a level substantially below the yield strength of the material from which the plate body is constructed.

2. The invention as in claim 1 wherein the spacing between the first and second heat transfer surfaces and the dimensions of the elliptical duct are such that the von Mises stress is less than the yield strength of the material from which the evaporator is constructed when the refrigerant has a pressure of approximately 1400 psig.

3. The invention as in claim 1 wherein at least one heat transfer surface contacts items to be frozen in a plate freezer.

4. The invention as in claim 1 wherein both heat transfer surfaces contact items to be frozen in a plate freezer.

5. The invention as in claim 1 wherein the duct extends throughout substantially the entire plate body in a serpentine manner.

6. The invention as in claim 5 wherein the plate body has a length and a width with the length substantially greater than the width and the serpentine duct extends substantially throughout the entire plate body along the length of the plate body.

7. The invention as in claim 5 wherein the serpentine duct makes seven passes through the plate body.

8. The invention as in claim 1 wherein the ratio between the total ellipse area to the total cross-sectional freezer-plate area is between about .57 and about .67.

9. The invention as in claim 1 wherein each elliptical duct has a first diameter and a second diameter, wherein the ratio between the first diameter and second diameter is between about 2.0 and about 2.35.

10. The invention as in claim 1 wherein the refrigerant passing through the evaporator is a CFC refrigerant.

11. The invention as in claim 1 wherein the refrigerant passing through the evaporator is a non-CFC refrigerant.

12. The invention as in claim 1 wherein the refrigerant passing through the evaporator is carbon dioxide.

13. The invention as in claim 1 wherein the refrigerant passing through the evaporator is ammonia.

14. The invention as in claim 1 wherein the refrigerant passing through the evaporator is at a pressure between about 100 psig and about 300 psig.

15. The invention as in claim 14 wherein the refrigerant passing through the evaporator is carbon dioxide.

16. A plate freezer comprising:

a compartment wherein the temperature of the compartment is less than or equal to approximately 0° Celsius; and

a plurality of spaced-apart shelves located in the compartment with each of the shelves adapted to receive items to be frozen between the adjacent shelves, each of the shelves include a plurality of generally rectangular plates having a length and a width with the length substantially greater than the width, the plates are disposed in an abutting relationship along their respective lengths, each plate has a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to define a plate body solid volume; and

at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant, at a level substantially below the yield strength of the material from which the plate body is constructed.

17. The invention as in claim 16 wherein the spacing between the first and second surfaces and the dimensions of the elliptical duct are such that the von Mises stress is less than the yield strength of the material from which the plate is constructed when the refrigerant has a pressure of approximately 1400 psig.

18. The invention as in claim 16 wherein the duct extends throughout substantially the entire plate body in a serpentine manner.

19. The invention as in claim 18 wherein the serpentine duct extends substantially throughout the entire plate body along the length of the plate body.

20. The invention as in claim 18 wherein the serpentine duct makes seven passes through the plate body.

21. The invention as in claim 16 wherein the ratio between the total ellipse area to the total cross-sectional freezer-plate area is between about .57 and about .67.

22. The invention as in claim 16 wherein each elliptical duct has a first diameter and a second diameter, wherein the ratio between the first diameter and second diameter is between about 2.0 and about 2.35.

23. The invention as in claim 16 wherein the refrigerant passing through the plate is a CFC refrigerant.

24. The invention as in claim 16 wherein the refrigerant passing through the plate is a non-CFC refrigerant.

25. The invention as in claim 16 wherein the refrigerant passing through the plate is carbon dioxide.

26. The invention as in claim 16 wherein the refrigerant passing through the plate is ammonia.

27. The invention as in claim 16 wherein the refrigerant passing through the plate is at a pressure between about 100 psig and about 200 psig.

28. The invention as in claim 27 wherein the refrigerant passing through the evaporator is carbon dioxide.

29. An evaporator for a plate freezer comprising:

a plurality of spaced-apart shelves located in the compartment with each of the shelves adapted to receive items to be frozen between the adjacent shelves, each of the shelves include a plurality of generally rectangular plates having a length and a width with the length substantially greater than the width, the plates are disposed in an abutting relationship along their respective lengths, each plate has a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to define a plate body solid volume;

at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant, at a level substantially below the yield

strength of the material from which the plate body is constructed; and

wherein the ratio between the total ellipse area in a plate to the total cross-sectional freezer plate area of that plate is between about .57 and about .67.

30. The invention as in claim 29 wherein the spacing between the first and second heat transfer surfaces and the dimensions of the elliptical duct are such that the von Mises stress is less than the yield strength of the material from which the evaporator is constructed when the refrigerant has a pressure of approximately 1400 psig.

31. The invention as in claim 29 wherein the duct extends throughout substantially the entire plate body in a serpentine manner.

32. The invention as in claim 31 wherein the plate body has a length and a width with the length substantially greater than the width and the serpentine duct extends substantially throughout the entire plate body along the length of the plate body.

33. The invention as in claim 31 wherein the serpentine duct makes seven passes through the plate body.

34. The invention as in claim 29 wherein each elliptical duct has a first diameter and a second diameter, wherein the ratio between the first diameter and second diameter is between about 2.0 and about 2.35.

35. The invention as in claim 29 wherein the refrigerant passing through the evaporator is a CFC refrigerant.

36. The invention as in claim 29 wherein the refrigerant passing through the evaporator is a non-CFC refrigerant.

37. The invention as in claim 29 wherein the refrigerant passing through the evaporator is carbon dioxide.

38. The invention as in claim 29 wherein the refrigerant passing through the evaporator is ammonia.

39. The invention as in claim 29 wherein the refrigerant passing through the evaporator is at a pressure between about 100 psig and about 200 psig.

40. The invention as in claim 39 wherein the refrigerant passing through the evaporator is carbon dioxide.

ABSTRACT OF THE INVENTION

An evaporator for use in a plate freezer utilizing carbon dioxide as the refrigerant has a duct with an elliptical shaped cross section. The duct allows a refrigerant, such as carbon dioxide, to pass through the evaporator to create a low-temperature freezer space.

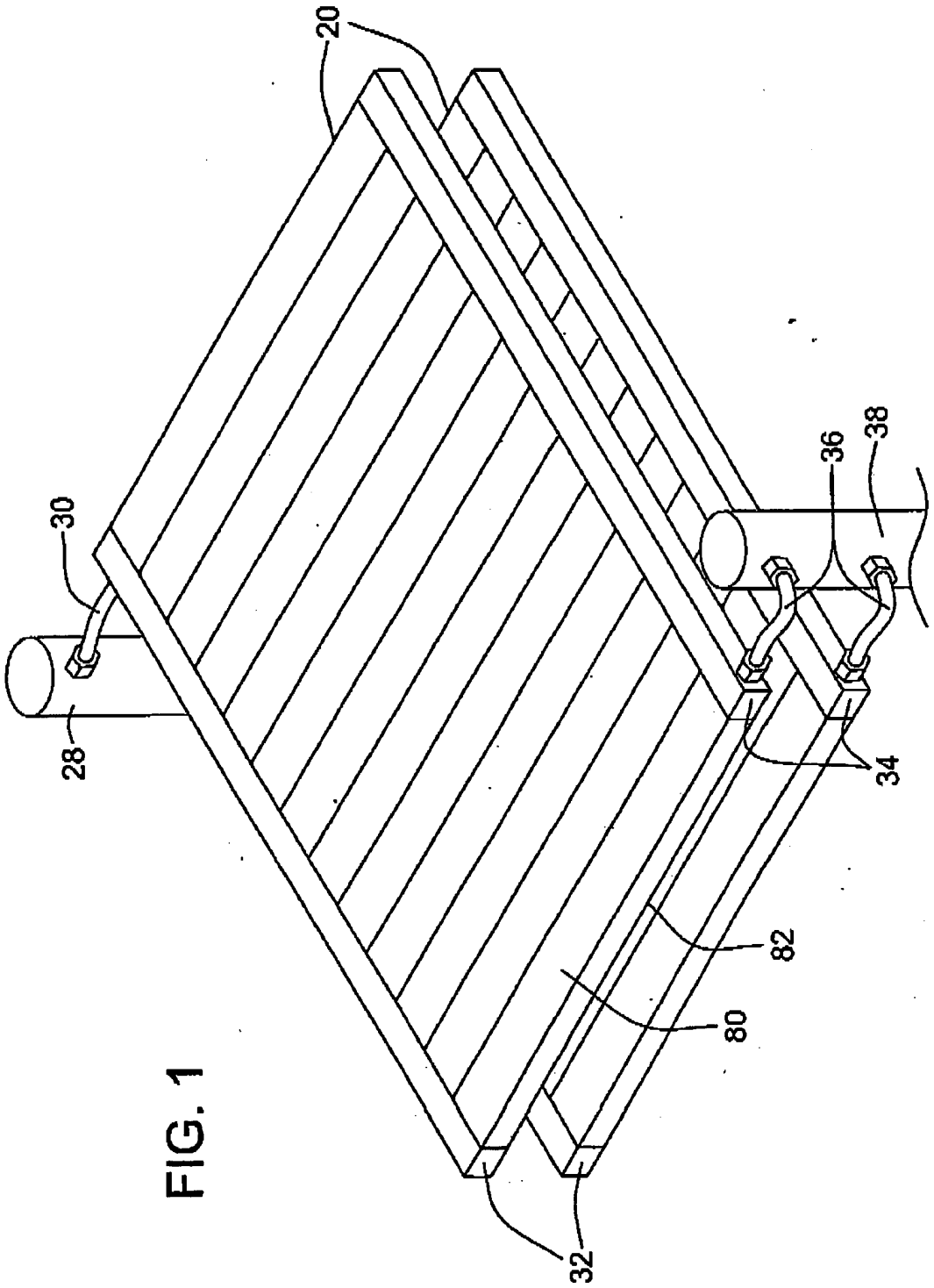


FIG. 1

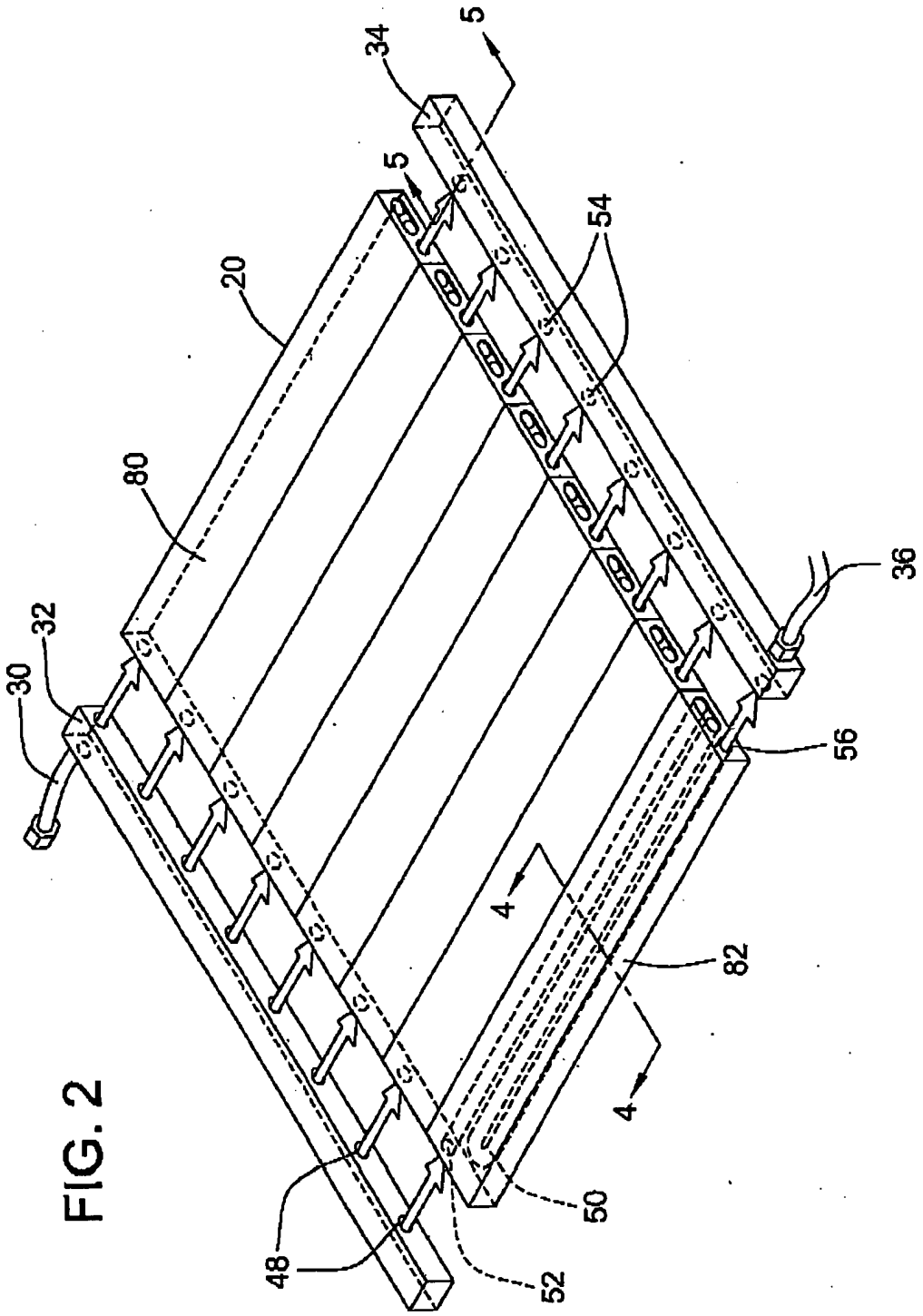
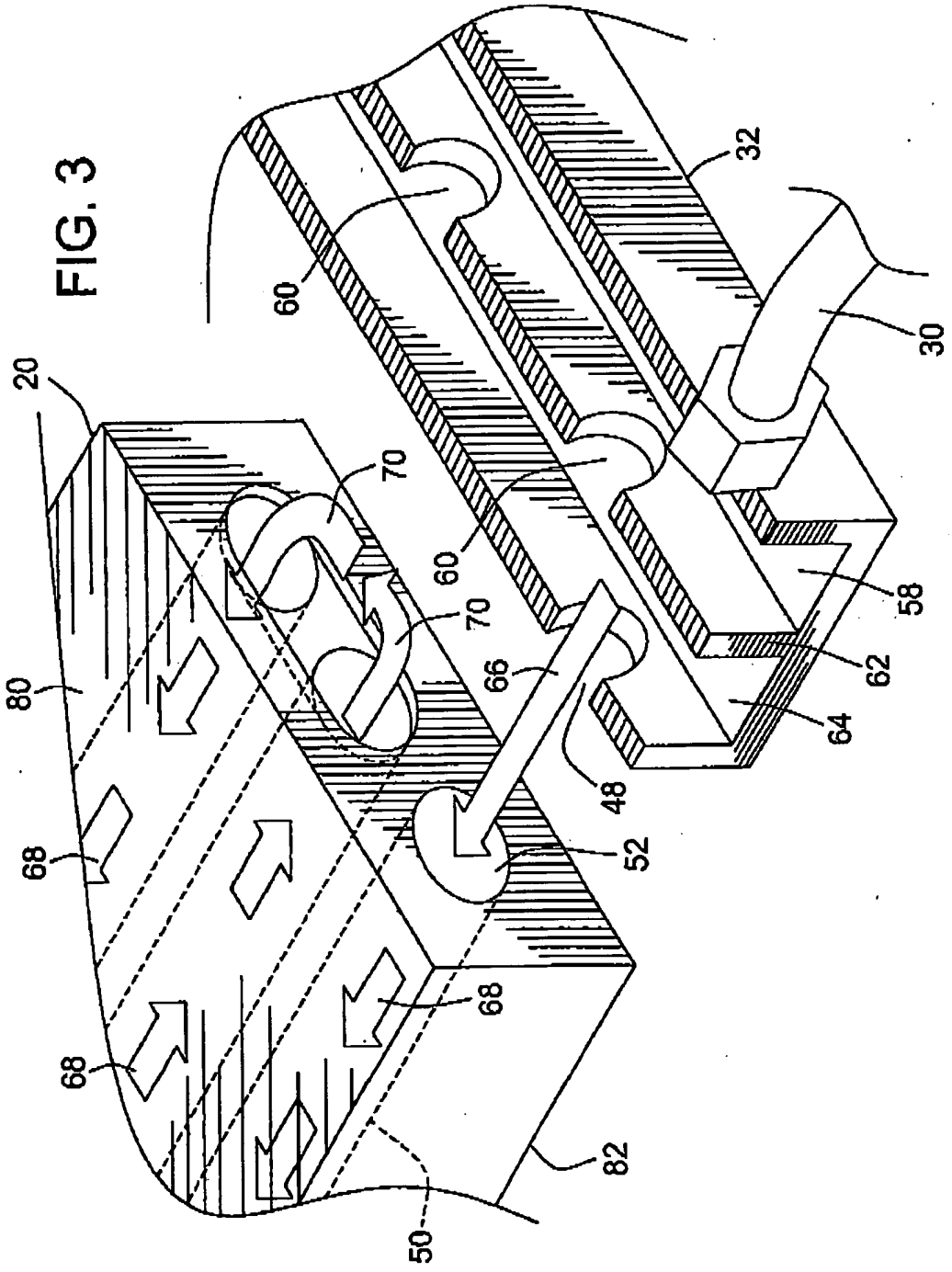


FIG. 2

FIG. 3



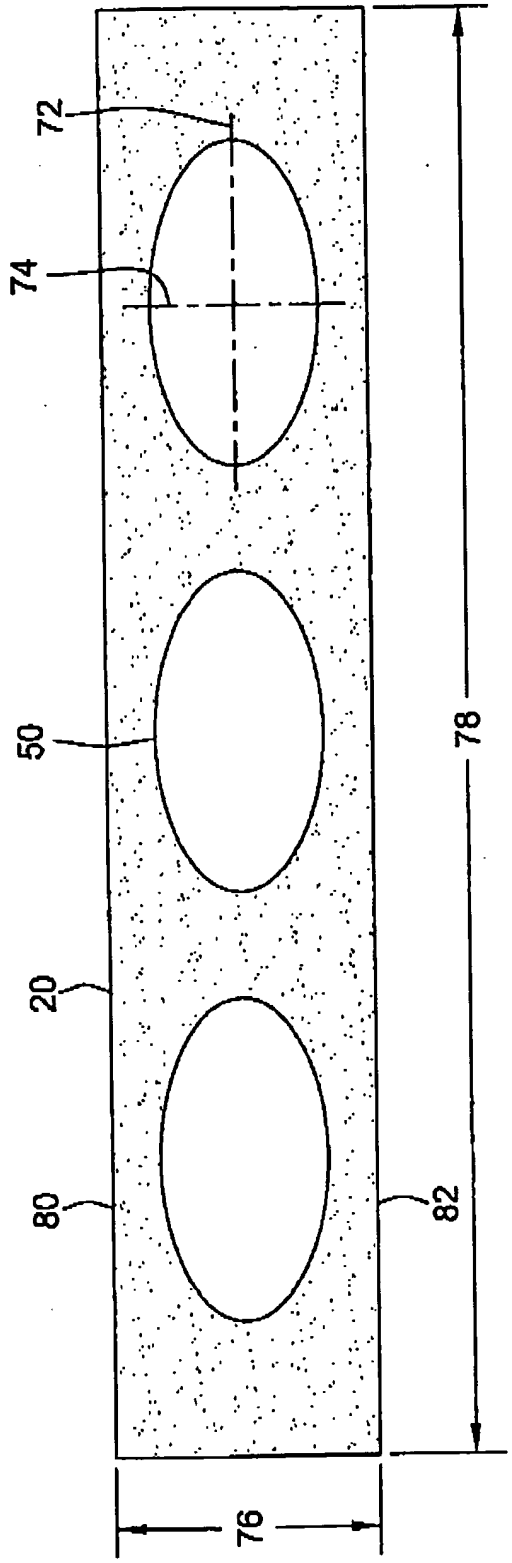


FIG. 4

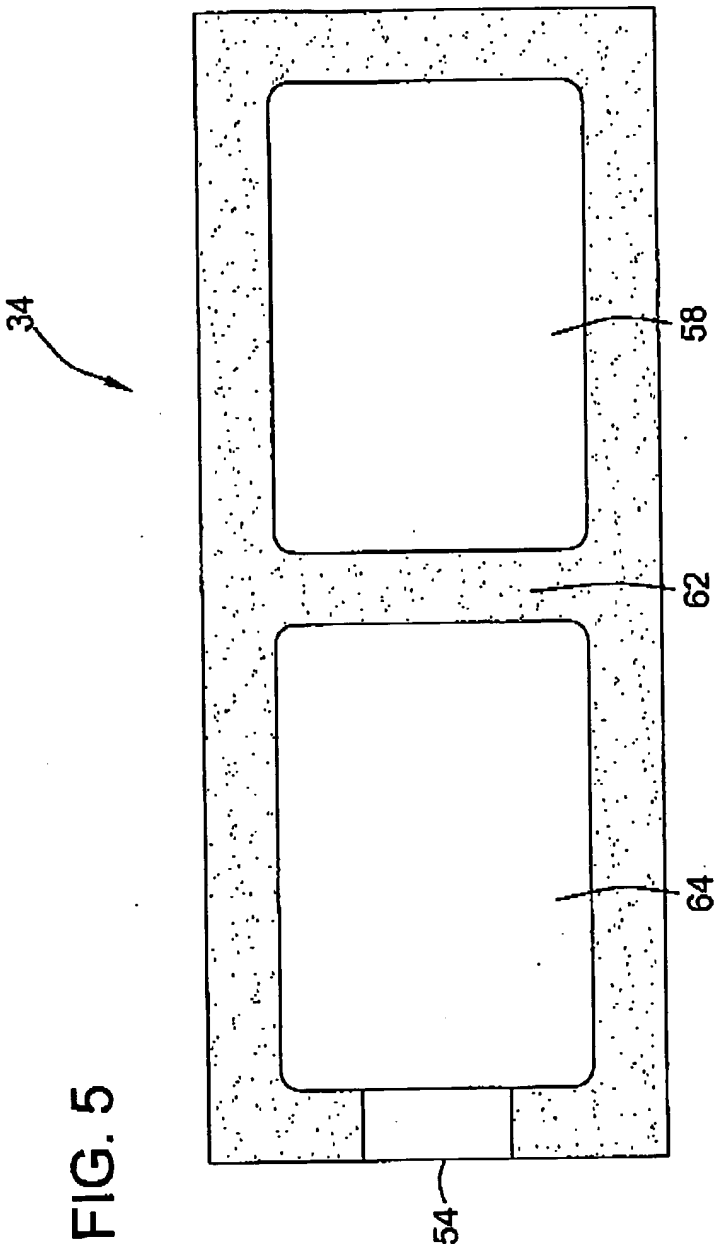


FIG. 5

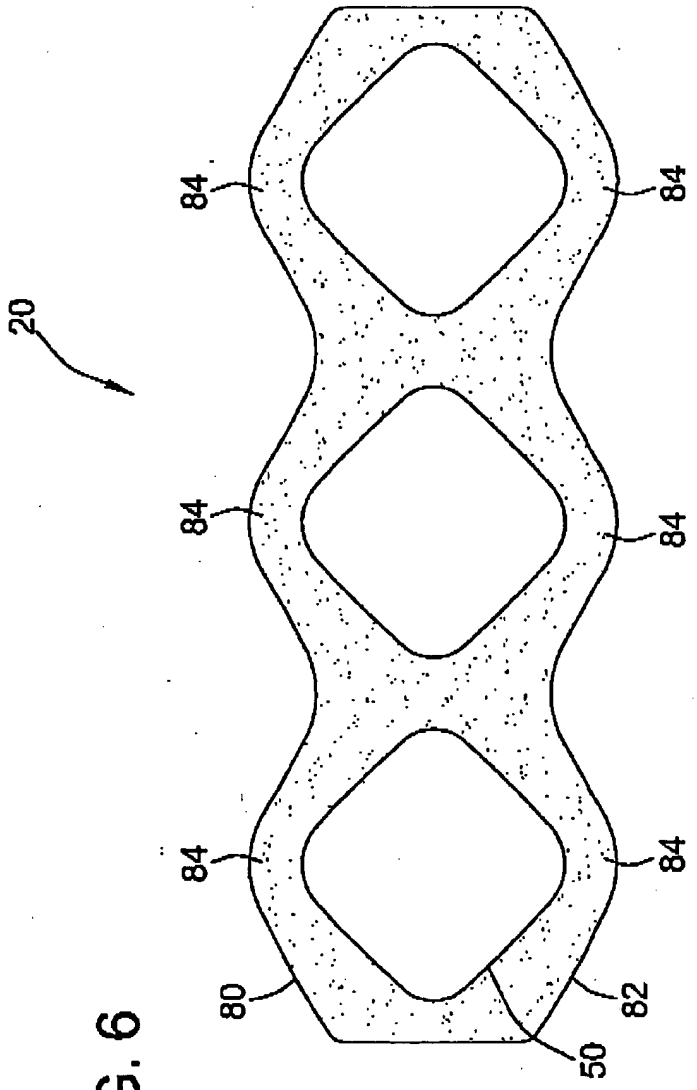


FIG. 6

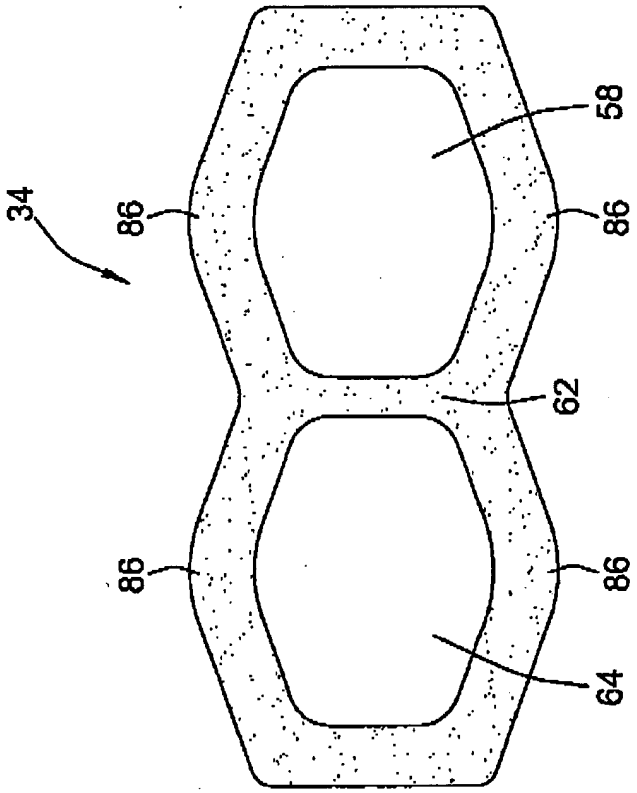


FIG. 7

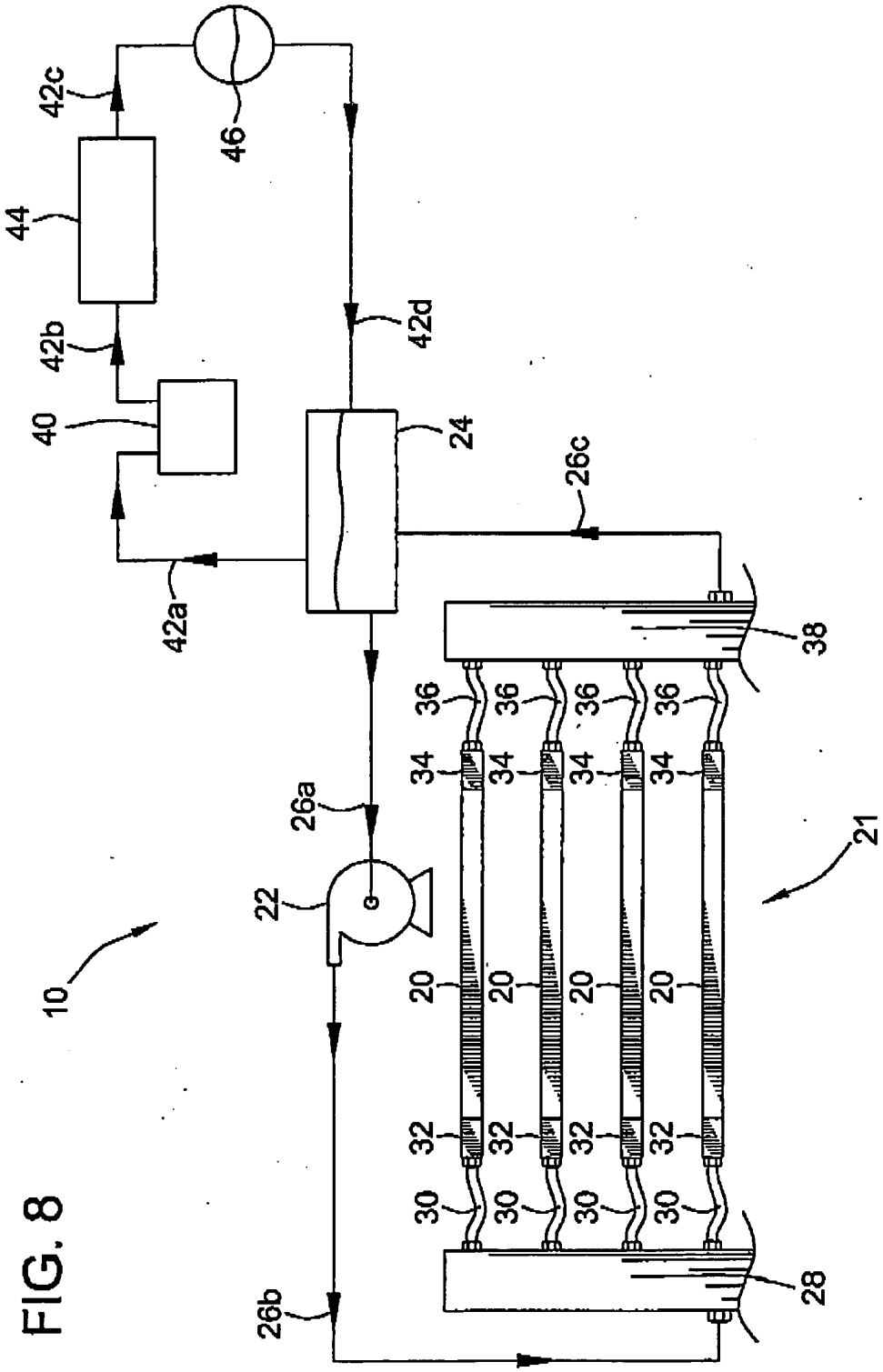


FIG. 8

PATENT
Attorney Docket No. 210030

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

This declaration is of the following type:

☒ original ☐ design ☐ supplemental
☐ national stage of PCT
☐ divisional ☐ continuation ☐ continuation-in-part

My residence, post office address, and citizenship are as stated below next to my name. I believe I am the original, first, and sole inventor *(if only one name is listed below)* or an original, first, and joint inventor *(if plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PLATE FREEZER EVAPORATOR WITH CARBON DIOXIDE REFRIGERANT

the specification of which:

☒ is attached hereto.
☐ was filed on as Application No. and was amended on *(if applicable)*.
☐ was filed by Express Mail No. *as Application No. not known yet*, and was amended on *(if applicable)*.
☐ was filed on as PCT International Application No. PCT/ and was amended on *(if any)*.

I state that I have reviewed and understand the contents of the specification identified above, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information that is material to the patentability of the application identified above in accordance with 37 CFR 1.56.

I claim foreign priority benefits under 35 USC 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate or 365(a) of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent, utility model, design registration, or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter and having a filing date before that of the application(s) from which the benefit of priority is claimed.

PRIOR FOREIGN PATENT/UTILITY MODEL AND DESIGN REGISTRATION APPLICATIONS						
COUNTRY	PRIOR FOREIGN APPLICATION NO.	DATE OF FILING (day, month, year)	PRIORITY CLAIMED			
				YES		NO
				YES		NO
				YES		NO

In re Appln. of Nanping Wu
Attorney Docket No. 210030

I claim the benefit pursuant to 35 USC 119(e) of the following United States provisional patent application(s):

PRIOR U.S. PROVISIONAL PATENT APPLICATIONS BENEFIT CLAIMED UNDER 35 USC 119(e)	
APPLICATION NO	DATE OF FILING (day, month, year)

I claim the benefit pursuant to 35 USC 120 of any United States patent application(s) or PCT International application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this patent application is not disclosed in the prior patent application(s) in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose material information as defined in 37 CFR 1.56 effective between the filing date of the prior patent application(s) and the national or PCT International filing date of this patent application.

PRIOR U.S. PATENT APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. BENEFIT CLAIMED UNDER 35 USC 120				
U.S. PATENT APPLICATIONS		Status (check one)		
U.S. APPLICATION NO	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
1.				
2.				
3.				

PCT APPLICATIONS DESIGNATING THE U.S.			Status (check one)		
PCT APPLICATION NO.	PCT FILING DATE (day, month, year)	U.S. APPLICATION NOS. ASSIGNED (if any)	PATENTED	PENDING	ABANDONED
4.					
5.					
6.					

DETAILS OF FOREIGN APPLICATIONS FROM WHICH PRIORITY CLAIMED UNDER 35 USC 119 FOR ABOVE LISTED U.S./PCT APPLICATIONS				
ABOVE APPLICATION NO.	COUNTRY	APPLICATION NO.	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)
1.				
2.				
3.				
4.				
5.				
6.				

In re Appln. of Nanping Wu
Attorney Docket No. 210030

As a named inventor, I hereby appoint Leydig, Voit & Mayer, Ltd. to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Customer Number 23460.

23460

PATENT TRADEMARK OFFICE

I further direct that correspondence concerning this application be directed to Leydig, Voit & Mayer, Ltd.: Customer Number 23460.

23460

PATENT TRADEMARK OFFICE

I declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: Nanping Wu

Inventor's signature Nanping Wu

Date June 23, 2001

Country of Citizenship: U.S.A.

Residence: 3040 Edenberry Street
Madison, WI 53711

Post Office Address: same as above

INVENTOR INFORMATION

Inventor One Given Name:: Nanping
Family Name:: WU
Postal Address Line One:: 3040 Edenberry Street
City:: Madison
State or Province:: Wisconsin
Country:: United States
Postal or Zip Code:: 53711
Citizenship Country:: United States

CORRESPONDENCE INFORMATION

Correspondence Customer Number:: 000023460
Electronic Mail One:: vleyva@leydig.com
Electronic Mail Two:: jlynch@leydig.com

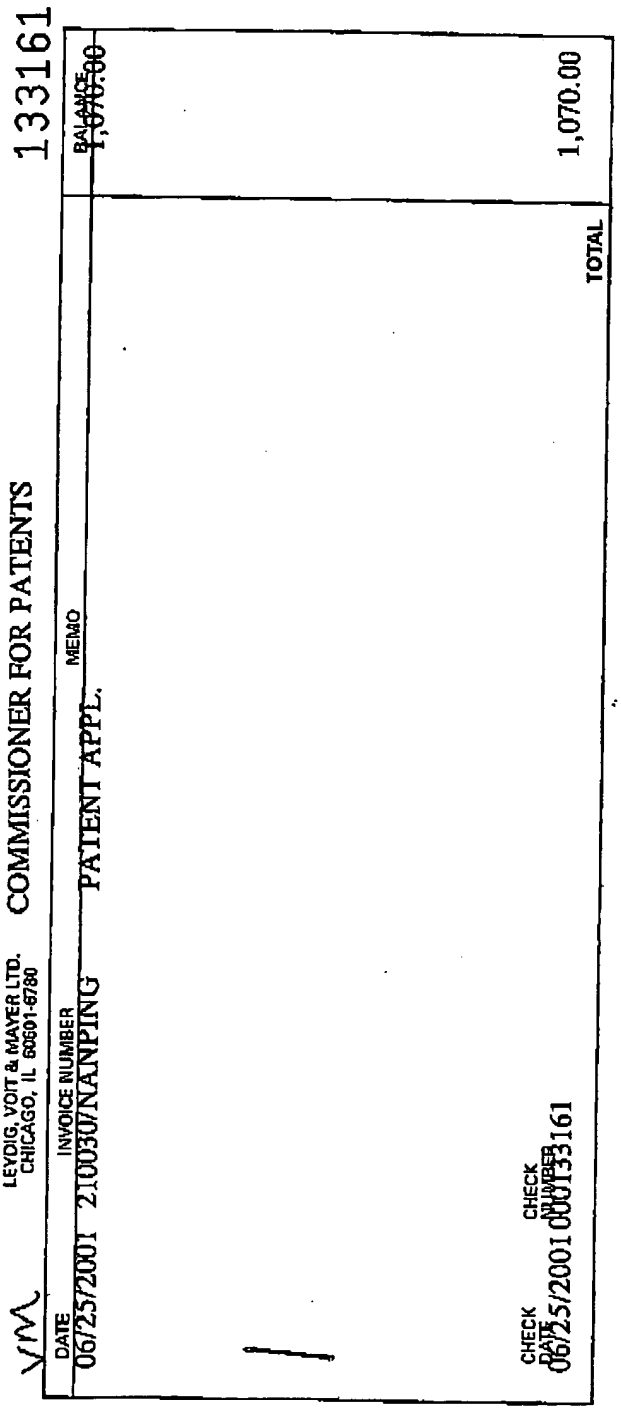
APPLICATION INFORMATION

Title Line One:: PLATE FREEZER EVAPORATOR WITH CARBON DIO
Title Line Two:: XIDE REFRIGERANT
Total Drawing Sheets:: 8
Formal Drawings?:: Yes
Application Type:: Utility
Docket Number:: 210030
Secrecy Order in Parent Appl.?:: No

REPRESENTATIVE INFORMATION

Representative Customer Number:: 23460

Source:: PrintEFS Version 1.0.1


133161
LEYDIG, VOIT & MAYER LTD.
CHICAGO, IL 60601-6780
COMMISSIONER FOR PATENTS
DATE
INVOICE NUMBER
MEMO
BALANCE
06/25/2001 210030/NANPING PATENT APPL. 1,070.00
TOTAL
1,070.00
CHECK DATE
06/25/2001
CHECK NUMBER
133161

THE PATENT AND TRADEMARK OFFICE IS RESPECTFULLY REQUESTED TO PLACE ITS STAMP ON THIS POSTAL CARD AND PLACE IT IN THE OUTGOING MAIL TO SHOW THE FOLLOWING PAPERS HAVE BEEN RECEIVED.

~~INVENSYS APV~~

Our Docket No.: 210030

NEW UTILITY PATENT APPLICATION
"PLATE FREEZER EVAPORATOR
WITH CARBON DIOXIDE REFRIGERANT"
Inventor: Ninping Wu

Enclosures: **Utility Patent Transmittal with Certificate of Mailing (2 pages in duplicate)**
Application Data Sheet (1 page)
Specification with Claims and Abstract (26 pages)
Drawings – Figs. 1 – 8 (8 sheets)
Combined Declaration and Power of Attorney (3 pages)
Check in the amount of $1,070.00
Postcard
Express Mail No. EL643484072US

JEL\vm

Date Mailed: **June 25, 2001**

EL643484072US

POST OFFICE TO ADDRESSEE

EXPRESS MAIL
UNITED STATES POSTAL SERVICE™

EL643484072US

EL643484072US

SEE REVERSE SIDE FOR SERVICE GUARANTEE AND LIMITS ON INSURANCE COVERAGE

Customer Copy
Label 11-F July 1997

ORIGIN (POSTAL USE ONLY)

PO ZIP Code: 60601 | Day of Delivery: Next ☐ Second ☒ | Flat Rate Envelope ☐
Date In: 6/25/01 | Noon ☒ 3 PM ☐ | Postage: $ 16.00
Time In: 19:14 | Military: 2nd Day ☐ 3rd Day ☐ | Return Receipt Fee
☐ AM ☒ PM
Weight: lbs. 6 oz. | Int'l Alpha Country Code | COD Fee | Insurance Fee
No Delivery: Weekend ☐ Holiday ☐ | Acceptance Clerk Initials: DE | Total Postage & Fees: $ 16.00

CUSTOMER USE ONLY
METHOD OF PAYMENT:
Express Mail Corporate Acct. No.
Federal Agency Acct. No. or Postal Service Acct. No.

WAIVER OF SIGNATURE (Domestic Only): Additional merchandise insurance is void if purchased. I wish delivery to be made without obtaining signature of addressee or addressee's agent (if delivery employee judges that article can be left in secure location) and I authorize that delivery employee's signature constitutes valid proof of delivery.
NO DELIVERY: Weekend ☐ Holiday ☐
Customer Signature

FROM: (PLEASE PRINT) PHONE 312 616 5600
LEIGH YUIT MAYER
180 N STETSON AVE STE 4900
2 PRUDENTIAL PLAZA
CHICAGO IL 60601-6716

TO: (PLEASE PRINT) PHONE ( )
ASSISTANT COMMISSIONER FOR
PATENTS
BOX Patent Application
WASHINGTON DC 20231-9998

JEL\vm 210030-INVENSYS

FOR PICKUP OR DELIVERY CALL 1-800-222-1811 www.usps.gov

THE PATENT AND TRADEMARK OFFICE IS RESPECTFULLY REQUESTED TO PLACE ITS STAMP ON THIS POSTAL CARD AND PLACE IT IN THE OUTGOING MAIL TO SHOW THE FOLLOWING PAPERS HAVE BEEN RECEIVED.

~~INVENSYS~~ PV LENNOX DOCKET NO. 210030

RECEIVED

JUL 11 2001

NEW UTILITY PATENT APPLICATION
"PLATE FREEZER EVAPORATOR
WITH CARBON DIOXIDE REFRIGERANT"
Inventor: Ninping Wu

PATENT Due Date

Enclosures: Utility Patent Transmittal with Certificate of Mailing
(2 pages in duplicate)
Application Data Sheet (1 page)
Specification with Claims and Abstract (26 pages)
Drawings – Figs. 1 – 8 (8 sheets)
Combined Declaration and Power of Attorney (3 pages)
Check in the amount of $1,070.00
Postcard

JC672 U.S. PTO
09/891576
06/25/01

DNG

Express Mail No. EL643484072US

LAH

JEL\vm

Date Mailed: June 25, 2001

Wom

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
09/891,576	06/25/2001	3744	1070	210030	8	40	3

CONFIRMATION NO. 3311

FILING RECEIPT

OC000000006429594

000023460
LEYDIG VOIT & MAYER, LTD
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, IL 60601-6780

Date Mailed: 08/15/2001

Receipt is acknowledged of this nonprovisional Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Customer Service Center. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).**

Applicant(s)
Nanping Wu, Madison, WI;

Domestic Priority data as claimed by applicant

Foreign Applications

AUG 2 0 2001
PATENTS Data Date noted

If Required, Foreign Filing License Granted 08/15/2001

Projected Publication Date: 12/26/2002

Non-Publication Request: No

Early Publication Request: No

Title
Plate freezer evaporator with carbon dioxide refrigerant

DNG LAH

Preliminary Class
062

Data entry by : TEGBARU, HAIMANOT **Team :** OIPE **Date:** 08/15/2001

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Office of Export Administration, Department of Commerce (15 CFR 370.10 (j)); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

PLEASE NOTE the following information about the Filing Receipt:

- The articles such as "**a**," "**an**" and "**the**" are not included as the first words in the title of an application. They are considered to be unnecessary to the understanding of the title.
- The words "**new**," "**improved**," "**improvements in**" or "**relating to**" are not included as first words in the title of an application because a patent application, by nature, is a new idea or improvement.
- The title may be truncated if it consists of more than 500 characters (letters and spaces combined).
- The docket number allows a maximum of 25 characters.
- If your application was submitted under 37 CFR 1.10, your filing date should be the "date in" found on the Express Mail label. If there is a discrepancy, you should submit a request for a corrected Filing Receipt along with a copy of the Express Mail label showing the "date in."
- The title is recorded in sentence case.

Any corrections that may need to be done to your Filing Receipt should be directed to:

Assistant Commissioner for Patents
Office of Initial Patent Examination
Customer Service Center
Washington, DC 20231

210030

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/891,576	06/25/2001	Nanping Wu	210030	3311

23460 7590 02/12/2002

LEYDIG VOIT & MAYER, LTD
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, IL 60601-6780

EXAMINER	
PATEL, NIHIR B	

ART UNIT	PAPER NUMBER
3743	

DATE MAILED: 02/12/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

LEYDIG, VOIT & MAYER

FEB 19 2002

PATITM Due Date 3/12/02 mjl
8/12/02 Final

1 MONTH

LAH AHF

PTO-90C (Rev. 07-01)

Office Action Summary	Application No. 09/891,576	Applicant WU, NANPING	
	Examiner Nihir Patel	Art Unit 3743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 2,8,9,17,21,22,29,30 and 34 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

1 MONTH

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) 2,8,9,17,21,22,29,30, and 34 are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

Part of Paper No. 1

Election/Restrictions

This application contains claims directed to the following patentably distinct species of the claimed invention: Figures 4 and 6 refer to tubes
Figures 5 and 7 refer to headers

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, claims 1,3-7,10-16,18-20,23-28,31-33, and 35-40 are generic.

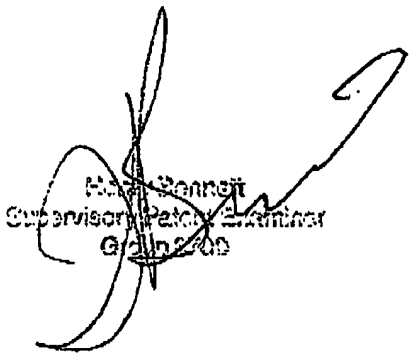
Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

Application/Control Number: 09/891,576
Art Unit: 3743

Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).



Attachment for PTO-948 (Rev. 03/01, or earlier)
6/18/01

The below text replaces the pre-printed text under the heading, "Information on How to Effect Drawing Changes." on the back of the PTO-948 (Rev. 03/01, or earlier) form.

INFORMATION ON HOW TO EFFECT DRAWING CHANGES

1. Correction of Informalities -- 37 CFR 1.85

New corrected drawings must be filed with the changes incorporated therein Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application If this information is provided, it must be placed on the front of each sheet and centered within the top margin. If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings **MUST** be filed within the **THREE MONTH** shortened statutory period set for reply in the Notice of Allowability Extensions of time may NOT be obtained under the provisions of 37 CFR 1 136(a) or (b) for filing the corrected drawings after the mailing of a Notice of Allowability The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson

2. Corrections other than Informalities Noted by Draftsperson on form PTO-948.

All changes to the drawings, other than informalities noted by the Draftsperson, **MUST** be made in the same manner as above except that, normally, a highlighted (preferably red ink) sketch of the changes to be incorporated into the new drawings **MUST** be approved by the examiner before the application will be allowed. No changes will be permitted to be made other than correction of informalities, unless the examiner has approved the proposed changes

Timing of Corrections

Applicant is required to submit the drawing corrections within the time period set in the attached Office communication See 37 CFR 1.85(a)

Failure to take corrective action within the set period will result in **ABANDONMENT** of the application.

FORM PTO-1083

PATENT
Attorney Docket No. 210030
Date: March 12, 2002

In re Application of: Nanping Wu
Application No. 09/891,576
Filed: June 25, 2001
For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Sir:

Transmitted herewith is a response to an office action in the subject application.

☐ Applicants claim small entity status of this application under 37 CFR 1.27.

☐ Petition for Extension of Time
- ☐ Applicants petition for a one-month extension of time under 37 CFR 1.136, the fee for which is $110.00 (enclosed).
- ☐ Applicants believe that no petition for an extension of time is necessary. However, to the extent that such petition is deemed necessary, Applicants hereby petition for a sufficient extension of time to render the present submission timely. Please charge Deposit Account No. 12-1216 for the appropriate petition fee.

☒ No additional claim fee is required.

☐ Other:

The claim fee has been calculated as shown below:

	Claims Remaining After Amendment		Highest Number Previously Paid For	Extra Claims Present	Small Entity: Rate	Small Entity: Addit. Claim Fee	Other Than A Small Entity: Rate	Other Than A Small Entity: Addit. Claim Fee
Total	40	Minus	40	=0	x 9=	$	x 18=	$0.00
Independent	3	Minus	3	=0	x 42=	$	x 84=	$0.00
☐ First Presentation of Multiple Claim					+ 140=	$	+ 280=	$
					Total	$	Total	$0.00

☐ Please charge my Deposit Account No. 12-1216 in the amount of $. A duplicate copy of this sheet is attached.

☐ A check in the amount of $ is attached.

☒ The Commissioner is hereby authorized to charge any deficiencies in the following fees associated with this communication or credit any overpayment to Deposit Account No. 12-1216. A duplicate copy of this sheet is attached.
- ☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.
- ☒ Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,

LEYDIG, VOIT & MAYER, LTD.

By Wesley O. Mueller
Wesley O. Mueller, Reg. No. 33,976

Leydig, Voit & Mayer, Ltd.
Two Prudential Plaza, Suite 4900
180 North Stetson
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

PATENT
Attorney Docket No. 210030

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Nanping Wu

Serial No. 09/891,576

Filed: June 25, 2001

Group Art Unit: 3743

Examiner: Nihir B. Patel

For: Plate Freezer Evaporator
With Carbon Dioxide Refrigerant

RESPONSE TO RESTRICTION REQUIREMENT

Commissioner For Patents
Washington, D.C. 20231

Dear Sir:

In response to the restriction requirement mailed February 12, 2002, applicant provisionally elects the invention of Group I relating to plate freezer tubes. However, all of applicant's claims (1-40) are presently believed to cover such subject matter.

Applicant submits that the claims presented herein are patentable. Prompt and favorable consideration is earnestly solicited.

Respectfully submitted,

LEYDIG, VOIT & MAYER, LTD.

Wesley O. Mueller
Reg. No. 33,976
Two Prudential Plaza – Suite 4900
Chicago, Illinois 60601
(312) 616-5600

Date: 3/12/07

In re Application of Wu.
Serial No. 09/891,576

CERTIFICATE OF MAILING

I hereby certify that this RESPONSE TO RESTRICTION REQUIREMENT (along with any attachments) is being sent via first-class mail, postage prepaid, addressed to: Attention: Examiner Nihir B. Patel, Assistant Commissioner For Patents, Washington, D.C. 20231, on March 12, 2002.

3/12/02 — Wesley O. Mueller

Date

m:\doc\pat\wom\210030RestrictionReq

THE PATENT AND TRADEMARK OFFICE IS RESPECTFULLY REQUESTED TO PLACE ITS STAMP ON THIS POSTAL CARD AND PLACE IT IN THE OUTGOING MAIL TO SHOW THE FOLLOWING PAPERS HAVE BEEN RECEIVED.

RECEIVED

APR 1 9 2002

In re Nanping Wu U.S. Serial No. 09/891,576
For: Plate Freezer, Evaporator With Carbon Dioxide Refrigerant

PAT/TM Due Date

Items:
1. Form PTO-1083 (1 pg.) (in duplicate)
2. Response To Restriction Requirement and Certificate of Mailing (2 pgs.)
3. Return Postcard

Date: March 12, 2002
Attorney Docket: 210030

WOM/mjd
Due: March 12, 2002

OIPE JC184 APR 1 1 2002 PATENT & TRADEMARK OFFICE

LAH AHF

Keyetch
Christina Masters

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
Washington, DC 20231
www.uspto.gov

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
09/891,576	06/25/2001	Nanping Wu	210030

CONFIRMATION NO. 3311

"OC0000000009289523"

000023460
LEYDIG VOIT & MAYER, LTD
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, IL 60601-6780

LEYDIG, VOIT & MAYER
RECEIVED
JAN 23 2003
PATTM Docs Date Noted

Title: Plate freezer evaporator with carbon dioxide refrigerant

Publication No. US-2002-0195234-A1
Publication Date: 12/26/2002

Date Mailed: 12/26/2002

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Crystal Gateway 4, Room 335, Washington, D.C. 20231, or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at (703) 305-3028.

Customer Service Center
Initial Patent Examination Division (703) 308-1202

RKS

AHF

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

cc: Carlson

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/891,576	06/25/2001	Nanping Wu	210030	3311

23460 7590 07/29/2003

LEYDIG VOIT & MAYER, LTD
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, IL 60601-6780

EXAMINER	
PATEL, NIHIR B	
ART UNIT	PAPER NUMBER
3743	5

DATE MAILED: 07/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

LEYDIG, VOIT & MAYER
RECEIVED
AUG 04 2003
PTO/TMS Date: Abandoned

AHF

LAH

PTO-90C (Rev. 07-01)

Notice of Abandonment	Application No. 09/891,576	Applicant(s) WU, NANPING	
	Examiner Nihir Patel	Art Unit 3743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

This application is abandoned in view of:

1. ☒ Applicant's failure to timely file a proper reply to the Office letter mailed on July 18th, 2002.
   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply (including a total extension of time of _____ month(s)) which expired on _____.
   (b) ☐ A proposed reply was received on _____, but it does not constitute a proper reply under 37 CFR 1.113 (a) to the final rejection.
   (A proper reply under 37 CFR 1.113 to a final rejection consists only of: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114).
   (c) ☐ A reply was received on _____ but it does not constitute a proper reply, or a bona fide attempt at a proper reply, to the non-final rejection. See 37 CFR 1.85(a) and 1.111. (See explanation in box 7 below).
   (d) ☒ No reply has been received.

2. ☐ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
   (a) ☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
   (b) ☐ The submitted fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____. The publication fee, if required by 37 CFR 1.18(d), is $_____.
   (c) ☐ The issue fee and publication fee, if applicable, has not been received.

3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
   (a) ☐ Proposed corrected drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.
   (b) ☐ No corrected drawings have been received.

AHF LAH

4. ☐ The letter of express abandonment which is signed by the attorney or agent of record, the assignee of the entire interest, or all of the applicants.

5. ☐ The letter of express abandonment which is signed by an attorney or agent (acting in a representative capacity under 37 CFR 1.34(a)) upon the filing of a continuing application.

6. ☐ The decision by the Board of Patent Appeals and Interference rendered on _____ and because the period for seeking court review of the decision has expired and there are no allowed claims.

7. ☒ The reason(s) below:
ATTACHED IS COPY OF ACTION MAILED 7/18/02 TO ADDRESS THAT CORRESPONDS TO LISTED ADDRESS PROVIDED TO PTO.

LEYDIG, VOIT & MAYER
RECEIVED
AUG 04 2003

Henry Bennett
Supervisory Patent Examiner
Group 3700

PTO/SB Due Date Abandoned

Petitions to revive under 37 CFR 1.137(a) or (b), or requests to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

Day : Monday
Date: 7/28/2003

Time: 09:43:33

PALM INTRANET

Correspondence Address for 09/891576

Customer Number	Contact Information	Address
23460	Telephone: (312)616-5600 Fax: No Fax # E-Mail: No E-Mail Address	LEYDIG VOIT & MAYER, LTD TWO PRUDENTIAL PLAZA, SUITE 4900 180 NORTH STETSON AVENUE CHICAGO IL 60601-6780

Application Data | Patent Data | Publication Info | Any Address Info | Continuity Data | Foreign Data

Search Another: Application# [ ] Search **or Patent#** [ ] Search

PCT / [ ] / [ ] Search **or PG PUBS #** [ ] Search

Attorney Docket # [ ] Search

Bar Code # [ ] Search

To go back use Back button on your browser toolbar.

Back to PALM | ASSIGNMENT | OASIS | Home page

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/891,576	06/25/2001	Nanping Wu	210030	3311

23460 7590 07/18/2002

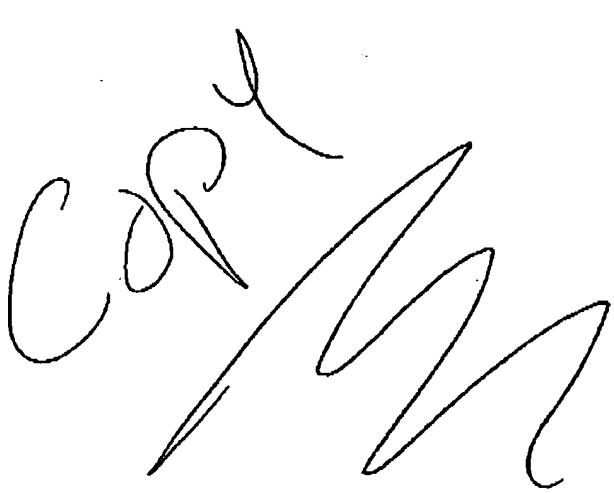
LEYDIG VOIT & MAYER, LTD
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, IL 60601-6780

EXAMINER	
PATEL, NIHIR B	

ART UNIT	PAPER NUMBER
3743	

DATE MAILED: 07/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.



PTO-90C (Rev. 07-01)

Application/Control Number: 09/891,576
Art Unit: 3743

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-4,6,7,10-16,19,20,23-30,32,33,35-40 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Referring to claim 1, there is insufficient antecedent basis for limitations "the plate body solid volume".

Referring to claims 2,10,11,12,13,14,15, and 30, there is insufficient antecedent basis for limitations "the evaporator".

Referring to claims 3 and 4, there is insufficient antecedent basis for limitations "a plate freezer".

Referring to claim 6, there is insufficient antecedent basis for limitations "the plate body".

Referring to claims 7,20, and 33, there is insufficient antecedent basis for limitations "the serpentine duct" and "the plate body".

Referring to claim 16, there is insufficient antecedent basis for limitations "the compartment" and "the plate body".

Referring to claims 19 and 32, there is insufficient antecedent basis for limitations "the entire plate body" and "the plate body".

Referring to claims 23,24,25,26, and 27, there is insufficient antecedent basis for limitations "the plate" and "the refrigerant".

Referring to claim 28,35,36,37,38,39, and 40 there is insufficient antecedent basis for limitations "the refrigerant" and "the evaporator".

Referring to claim 29, there is insufficient antecedent basis for limitations "the plate body solid volume" and "the plate body".

Claim Rejections - 35 USC § 102(e)

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1,2,5,6, 12, and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Dienhart et al. U.S. Patent No. 6,357,522. Referring to claim 1, Dienhart discloses a multi-channel flat tube that comprises a longitudinally extending plate body having a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface to define a plate body solid volume (Refer to figures1 through 3); and at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant, at a level substantially below the yield strength of the material from which the plate body is constructed (Refer to figures 1 through 3).

Referring to claim 2, Dienhart clearly shows that the spacing between the first and second heat transfer surfaces and the dimensions of the elliptical duct are such that the von Mises stress is less than the yield strength of the material from which the evaporator is constructed when the refrigerant has a pressure of approximately 1400 psig (Refer to column 4 lines 5 through 12).

Referring to claim 5, Dienhart clearly shows that the duct extends throughout substantially the entire plate body in a serpentine manner (Refer to column 4 lines 1 through 5).

Referring to claim 6, Dienhart clearly shows that the plate body has a length and a width with the length substantially greater than the width and the serpentine duct extends substantially throughout the entire plate body along the length of the body (Refer to figures 1 through 3 and column 4 lines 1 through 5).

Referring to claims 12 and 15, Dienhart clearly shows that the refrigerant passing through the evaporator is carbon dioxide. Refer to the abstract.

Claim Rejections - 35 USC § 102(b)

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kato U.S. Patent No. 5,768,782. Referring to claim 1, Kato discloses a flat tube for heat exchanger and method for manufacturing it that comprises a longitudinally extending plate body having a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to be define a plate body solid volume (Refer to figure 1); and at least

one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant, at a level substantially below the yield strength of the material from which the plate body is constructed (Refer to figure 1 and column 4 lines 19 through 24).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2,17 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato U.S. Patent No. 5,768,782 in view of Dienhart et al. U.S. Patent No. 6,357,522.

Kato discloses the applicant's invention as claimed with the exception of stating that the von Mises stress is less than the yield strength of the material from which the evaporator is constructed when the refrigerant has a pressure of approximately 1400 psig.

Dienhart discloses a multi-channel flat tube that does state that the von Mises stress is less than the yield strength of the material from which the evaporator is constructed when the refrigerant has a pressure of approximately 1400 psig. Therefore it would be obvious to modify Kato's invention by stating that the von Mises stress is less than the yield strength of the material from which the evaporator is constructed when the refrigerant has a pressure of approximately 1400 psig so that one knows the limitations of the invention.

Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dienhart et al. U.S. Patent No. 6,357,522 or Kato U.S. Patent No. 5,768,782 in view of Perryment et al. U.S. Patent No. 5,860,471.

Referring to claim 3, Dienhart and Kato discloses the applicant's invention as claimed with the exception of stating that at least one heat transfer surface contacts items to be frozen in a plate freezer.

Perryment discloses a heat exchanger device that does state that at least one heat transfer surface contacts items to be frozen in a plate freezer. Therefore it would be obvious to modify Dienhart's and Kato's invention by stating that at least one heat transfer surface contacts items to be frozen in a plate freezer so that one knows the limitations of the invention.

Referring to claim 4, Dienhart and Kato discloses the applicant's invention as claimed with the exception of stating that both heat transfer surfaces contact items to be frozen in a plate freezer. Therefore it would be obvious to modify Dienhart's and Kato's invention by stating that at least one heat transfer surface contacts items to be frozen in a plate freezer so that one knows the limitations of the invention.

Claims 5,6,18,19,31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato U.S. Patent No. 5,768,782 in view of Matsuo et al. U.S. Patent No. 5,927,102.

Referring to claims 5,18 and 31, Kato discloses the applicant's invention as claimed with the exception providing a duct that extends throughout the entire plate assembly in a serpentine manner.

Matsuo discloses a receiver-integrated condenser for refrigerating system that does provide a duct that extends throughout the entire plate assembly in a serpentine manner.

Therefore it would be obvious to modify Kato's invention by providing a duct that extends throughout the entire plate assembly in a serpentine manner in order to get a smoother flow.

Referring to claims 6,19 and 32, Kato discloses the applicant's invention as claimed with the exception of providing a serpentine duct that extends substantially throughout the entire plate body along the length of the plate body.

Matsuo discloses a receiver-integrated condenser for refrigerating system that does provide a serpentine duct that extends substantially throughout the entire plate body along the length of the plate body. Therefore it would be obvious to modify Kato's invention by providing a serpentine duct that extends substantially throughout the entire plate body along the length of the plate body to increase the cooling process.

Referring to claims 7,20 and 33, the applicant claims that the serpentine duct makes seven passes through the plate body. It is obvious to one in the ordinary skill of the art that the amount of serpentine duct that pass through the plate body is simply a matter of design choice. The amount of serpentine duct in plate body depends on where the invention is going to be applied.

Referring to claims 8,21 and 29, the applicant claims that the ratio between the total ellipse area to the total cross-sectional freezer-plate area is between about 0.57 and about 0.67. It is obvious to one in the ordinary skill of the art that the ratio between the total ellipse area to the total cross-sectional freezer-plate area is simply a matter of design choice. The ratio between the total ellipse area to the total cross-sectional freezer-plate area depends on where the invention is going to be applied.

Referring to claims 9,22 and 34, the applicant states that each elliptical duct has a first diameter and a second diameter, wherein the ratio between the first and second diameter is between about 2.0 and about 2.35. It is obvious to one in the ordinary skill of the art that the ratio between the first diameter and second diameter is simply a matter of design choice. The ratio between the first and second diameter depends on where the invention is going to be applied.

Claims 10,12,15,23,25,28,35,37 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato U.S. Patent No. 5,768,782 in view of Johnson et al. U.S. Patent No. 5,320,167.

Kato discloses the applicant's invention with the exception of stating that the refrigerant passing through the evaporator is a CFC-refrigerant or carbon dioxide.

Johnson discloses an air conditioning and refrigeration systems utilizing a cryogen and heat pipes that does state that the refrigerant could be either a CFC-refrigerant or carbon dioxide. Therefore it would be obvious to modify Kato's invention by stating that the refrigerant passing through the evaporator is a CFC-refrigerant or carbon dioxide so that one knows the limitations of the invention.

Claims 11,13,24,26,36 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato U.S. Patent No. 5,768,782 in view of Gilley et al. U.S. Patent No. 5,737,923.

Kato discloses the applicant's invention as claimed with the exception of stating that the refrigerant passing through the evaporator is a non-CFC refrigerant or ammonia.

Gilley discloses a thermoelectric device with evaporating/condensing heat exchanger that does state that the refrigerant passing through the evaporator is a non-CFC refrigerant or ammonia. Therefore it would be obvious to modify Kato's invention by stating that that the

refrigerant passing through the evaporator is a non-CFC refrigerant or ammonia so that one knows the limitations of the invention.

Claims 14,27 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kato U.S. Patent No. 5,768,782 in view of Dowling U.S. Patent No. 4,235,081.

Kato discloses the applicant's invention as claimed with the exception of stating that the refrigerant passing through the evaporator is at a pressure between about 100 psig and about 300 psig.

Dowling discloses a compressed air dryer that does state that the refrigerant passing through the evaporator is at a pressure between about 100 psig and about 300 psig. Therefore it would be obvious to modify Kato's invention by stating that the refrigerant passing through the evaporator is at a pressure between about 100 psig and about 300 psig so that one knows the limitations of the invention. The pressure of the fluid used in the invention does not have anything to do with the apparatus (evaporator).

Further stated in *Ex parte Masham*, "a recitation with respect to the material intended to be worked upon by a claimed apparatus does not impose any structural limitations upon the claimed apparatus which differentiates it from a prior art apparatus satisfying the structural limitations of that claimed."

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kato U.S. Patent No. 5,768,782 in view of Seol U.S. Patent No. 6,006,533.

Kato discloses the applicant's invention as claimed with the exception of stating that the temperature within the compartment is less than or equal to 0 degrees Celsius.

Seol discloses a driving control apparatus of kimchi jar and method thereof that does state that the temperature is less than or equal to 0 degrees Celsius. Therefore it would be obvious to modify Kato's invention by stating that the temperature within the compartment is less than or equal to 0 degrees Celsius so that one knows the limitations of the invention.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Nihir Patel whose telephone number is (703) 306-3463. The examiner can normally be reached on Monday-Friday from 7:30 am to 4:30 pm. If attempts to reach the examiner by telephone are unsuccessful the examiner supervisor Henry Bennett can be reached at (703) 308-0101.

NP
July 3, 2002

Henry Bennett
Supervisory Patent Examiner
Art Unit 3700

REVISED AMENDMENT PRACTICE: 37 CFR 1.121 CHANGED COMPLIANCE IS MANDATORY - Effective Date: July 30, 2003

All amendments filed on or after the effective date noted above must comply with revised 37 CFR 1.121. See Final Rule: **Changes To Implement Electronic Maintenance of Official Patent Application Records** (68 *Fed. Reg.* 38611 (June 30, 2003), posted on the Office's website at: http://www.uspto.gov/web/patents/ifw/ with related information. The amendment practice set forth in revised 37 CFR 1.121, and described below, replaces the voluntary revised amendment format available to applicants since February 2003. **NOTE: STRICT COMPLIANCE WITH THE REVISED 37 CFR 1.121 IS REQUIRED AS OF THE EFFECTIVE DATE (July 30, 2003).** The Office will notify applicants of amendments that are not accepted because they do not comply with revised 37 CFR 1.121 via a Notice of Non-Compliant Amendment. See MPEP 714.03 (Rev. 1, Feb. 2003). The non-compliant section(s) will have to be corrected and the entire corrected section(s) resubmitted within a set period.

Bold underlined italic font has been used below to highlight the major differences between the revised 37 CFR 1.121 and the voluntary revised amendment format that applicants could use since February, 2003.
Note: The amendment practice for **reissues** and **reexamination proceedings**, except for drawings, has not changed.

REVISED AMENDMENT PRACTICE

I. Begin each section of an amendment document on a separate sheet:
Each section of an amendment document (*e.g.*, Specification Amendments, Claim Amendments, Drawing Amendments, and Remarks) must begin on a separate sheet. Starting each separate section on a new page will facilitate the process of separately indexing and scanning each section of an amendment document for placement in an image file wrapper.

II. Two versions of amended part(s) no longer required:
37 CFR 1.121 has been revised to no longer require two versions (a clean version and a marked up version) of each replacement paragraph or section, or amended claim. Note, however, the requirements for a clean version and a marked up version for substitute specifications under 37 CFR 1.125 have been retained.

A) Amendments to the claims:
Each amendment document that includes a change to an existing claim, cancellation of a claim or submission of a new claim, **must include a complete listing** of all claims in the application. After each claim number in the listing, the status must be indicated in a parenthetical expression, and **the text of each pending claim** (with markings to show current changes) must be presented. The claims in the listing will replace all prior claims in the application.

(1) The current status of all of the claims in the application, including any previously canceled, not entered or withdrawn claims, must be given in a parenthetical expression following the claim number using only one of the following seven status identifiers: (original), (currently amended), (canceled), (withdrawn), (new), ***(previously presented) and (not entered).*** The text of all pending claims, ***including withdrawn claims,*** must be submitted each time any claim is amended. Canceled ***and not entered*** claims must be indicated by only the claim number and status, without presenting the text of the claims.

(2) The text of all claims being currently amended must be presented in the claim listing with markings to indicate the changes that have been made relative to the immediate prior version. The changes in any amended claim must be shown by underlining (for added matter) or strikethrough (for deleted matter) with 2 exceptions: (1) for ***deletion of five characters or fewer, double brackets may be used (e.g., [[eroor]]); and (2) if strikethrough cannot be easily perceived (e.g., deletion of the number "4" or certain punctuation marks), double brackets must be used (e.g., [[4]]). As an alternative to using double brackets, however, extra portions of text may be included before and after text being deleted, all in strikethrough, followed by including and underlining the extra text with the desired change*** (*e.g.*, ~~number 1 or~~ ***number 14 or***). An accompanying clean version is not required and should not be presented. Only claims of the status "currently amended," and "withdrawn" that are being amended, may include markings.

(3) The text of pending claims not being currently amended, ***including withdrawn claims,*** must be presented in the claim listing in clean version, *i.e.*, without any markings. Any claim text presented in clean version will constitute an assertion that it has not been changed relative to the immediate prior version except to omit markings that may have been present in the immediate prior version of the claims.

RECEIVED
CENTRAL FAX CENTER
MAR 2 7 2007

PATENT
Attorney Docket No. 210030

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Nanping Wu

Serial No. 09/891,576 Art Unit 3743

Filed: June 25, 2001 Examiner Nihir B Patel

For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

PETITION FOR REVIVAL OF A PATENT APPLICATION ABANDONED UNINTENTIONALLY UNDER 37 CFR §1.137 (b)

Mail Stop Petition
Commissioner For Patents
P. O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

Applicant hereby petitions for revival of the above-identified patent application.

The application became abandoned for failure to file a timely response to an Office Action that was apparently mailed on July 18, 2002, but was not received by Applicant even though various requests that such Action be provided were made. The date of abandonment is the day after the expiration date of October 18, 2002, the date set for reply in the Office Action. This Petition is being mailed within the three months of the date notification of the abandonment was provided.

1. Petition Fee

☒ Applicant claims other than small entity status. See 37 CFR 1.17(m).

The petition fee due in this application is $1,330.00.

2. Payment of Fee

☐ Attached is a check in the amount of $_____ for the petition fee and the extension fee.

Certification under 37 C.F.R. § 1.10 (if applicable)

EL 336876910 US	October 29, 2003
"Express Mail" Mailing Number	Date of Deposit

I hereby certify that this application is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop Petition, Commissioner for Patents, P. O. Box 1450, Alexandria, Virginia 22313-1450.

Margaret J. DiGrazia	Margaret J. DiGrazia
Typed or Printed Name of Person Making Deposit	Signature of Person Making Deposit

In re Appln. of Nanping Wu
Application No. 09/981,576

☒ Charge Deposit Account No. 12-1216 in the sum of $1,330.00 for the petition fee. A duplicate copy of this request is attached.
☒ Charge Deposit Account No. 12-1216 for any fee deficiency.

3. Terminal Disclaimer with Disclaimer Fee

☒ Since this patent application was filed on or after June 8, 1995, no terminal disclaimer is required

☐ A terminal disclaimer (and disclaimer fee (37 CFR 1.20(d)) of $ disclaiming the required period of time is enclosed herewith.

4. Statement

The entire delay in filing the required reply from the due date for the required reply until the filing of a grantable petition under 37 CFR 1.137(b) was unintentional.

Respectfully submitted,

Wesley O. Mueller

Wesley O. Mueller - Reg. No. 33,976
One of the Attorneys for Applicant(s)
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

Date: October 29, 2003
Enclosure

EV 336876910 US

Customer Copy
Label 11-F June 2002

EXPRESS MAIL
UNITED STATES POSTAL SERVICE®

Post Office To Addressee

ORIGIN (POSTAL USE ONLY)

PO ZIP Code: 60601	Day of Delivery: ☐ Next ☒ Second	Flat Rate Envelope: ☐	
Date In: Mo. 10 Day 29 Year 03	☒ 12 Noon ☐ 3 PM	Postage: $ 13.05	
Time In: 5:00 ☐ AM ☒ PM	Military: ☐ 2nd Day ☐ 3rd Day	Return Receipt Fee	
Weight: lbs. 3 ozs.	Int'l Alpha Country Code	COD Fee	Insurance Fee
No Delivery: ☐ Weekend ☐ Holiday	Acceptance Clerk Initials: KDW	Total Postage & Fees: $ 13.05	

DELIVERY (POSTAL USE ONLY)

Delivery Attempt: Mo. Day	Time: ☐ AM ☐ PM	Employee Signature
Delivery Attempt: Mo. Day	Time: ☐ AM ☐ PM	Employee Signature
Delivery Date: Mo. Day	Time: ☐ AM ☐ PM	Employee Signature

☐ WAIVER OF SIGNATURE (Domestic Only): Additional postage is paid and waiver of signature is requested. I will delivery to be made without obtaining addressee's or addressee's agent's (if any) employee's signature. I authorize that article can be left in secure location. I agree that delivery employee's signature constitutes proof of delivery.

NO DELIVERY ☐ Weekend ☐ Holiday

Customer Signature

CUSTOMER USE ONLY

METHOD OF PAYMENT:
Express Mail Corporate Acct. No.

Federal Agency Acct. No. or Postal Service Acct. No.

FROM: (PLEASE PRINT) PHONE 312 616 5000

LEYDIG VOIT MAYER
180 N STETSON AVE STE 4900
2 PRUDENTIAL PLAZA
CHICAGO IL 60601-6780

Attention: Wesley O. Mueller

(Docket 210030)

TO: (PLEASE PRINT) PHONE

MS PETITION
COMMISSIONER FOR PATENTS
PO BOX 1450
ALEXANDRIA VA 22313-1450

PRESS HARD.
You are making 3 copies.

FOR PICKUP OR TRACKING CALL 1-800-222-1811 www.usps.com

EMS

THE PATENT AND TRADEMARK OFFICE IS RESPECTFULLY REQUESTED TO PLACE ITS STAMP ON THIS POSTAL CARD AND PLACE IT IN THE OUTGOING MAIL TO SHOW THE FOLLOWING PAPERS HAVE BEEN RECEIVED.

LEYDIG, VOIT & MAYER
RECEIVED

NOV 04 2003

PAT/TM Due Date

In re Nanping Wu U.S. Serial No. 09/891,576
For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

Items:
1. Petition For Revival of a Patent Application Abandoned Unintentionally Under 37 CFR 1.137(b) (2 pgs. in duplicate)
2. Express Mailing Label EV 336876910 US

Date Mailed via Express Mail: October 29, 2003
Attorney Docket: 210030
WOM/mjd

LAH

OIPE
OCT 29 2003
PATENT & TRADEMARK OFFICE

ARH

Mark Jay

cc: Carlos C.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

LEYDIG, VOIT & MAYER
RECEIVED
DEC 0 8 2003

Paper No. 7

Leydig Voit & Mayer, LTD
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, IL 60601-6780

PAT/TM Due Date 2/2/04
6/2/04 (Final)

COPY MAILED
DEC 0 2 2003
OFFICE OF PETITIONS

In re Application of
Nanping Wu
Application No. 09/891,576
Filed: June 25, 2001
Attorney Docket No. 210030

ON PETITION

CTC
ARH

This is a decision on the petition under 37 CFR 1.137(b), filed October 29, 2003, to revive the above-identified application.

The petition is DISMISSED.

Any request for reconsideration of this decision must be submitted within TWO (2) MONTHS from the mail date of this decision. Extensions of time under 37 CFR 1.136(a) are permitted. The reconsideration request should include a cover letter entitled ☐Renewed Petition under 37 CFR 1.137(b).☐ This is not final agency action within the meaning of 5 U.S.C. 704.

A grantable petition under 37 CFR 1.137(b) must be accompanied by: (1) the required reply, unless previously filed; (2) the petition fee as set forth in 37 CFR 1.17(m); (3) a statement that the entire delay in filing the required reply from the due date for the reply until the filing of a grantable petition pursuant to 37 CFR 1.137(b) was unintentional; and (4) any terminal disclaimer (and fee as set forth in 37 CFR 1.20(d)) required by 37 CFR 1.137(c). Where there is a question as to whether either the abandonment or the delay in filing a petition under 37 CFR 1.137 was unintentional, the Commissioner may require additional information. See MPEP 711.03(c)(III)(C) and (D). The instant petition lack(s) item(s) (1).

As to item (1), There is no indication that a response to the Office action mailed July 18, 2002 has been submitted. Accordingly, a proper reply to the Office action must be submitted before revival of the application can be effected.

The required reply to a non-final action in a non-provisional application abandoned for failure to prosecute may be either: (A) an argument or an amendment under 37 CFR 1.111 or; (B) the filing of a continuing application under 37 CFR 1.53(b).

The grant of a petition under 37 CFR 1.137 is not a determination that any reply under 37 CFR 1.111 is complete. Where the proposed reply is to a non-final Office action, the petition may be granted if the reply appears to be bona fide. After revival of the application, the patent examiner may, upon more detailed review, determine that the reply is lacking in some respect. In this limited situation, the patent examiner should send out a letter giving a 1-month

shortened imited situation, the patent examiner should send out a letter giving a 1-month shortened statutory period under 37 CFR 1.135(c) for correction of the error or omission. Extensions of time under 37 CFR 1.136(a) are permitted. If applicant does not correct the omission within the time period set in the letter (including any extension), the application is again abandoned. See MPEP 711.03(c).

Further correspondence with respect to this matter should be addressed as follows:

By mail: Mail Stop PETITION
Commissioner for Patents
Post Office Box 1450
Alexandria, VA 22313-1450

By hand: Crystal Plaza Four, Suite 3C23
2201 South Clark Place
Arlington, VA 22202

By Fax: (703) 308-6916
ATTN: Office of Petitions

Telephone inquiries concerning this decision should be directed the undersigned at (703) 308-6911.

Latrice Bond
Petitions Examiner
Office of Petitions
Office of the Deputy Commissioner
for Patent Examination Policy

Attachment: non-final Office action

UNITED STATES PATENT AND TRADEMARK OFFICE
SPECIAL PROGRAM LAW OFFICE/OFFICE OF PETITIONS

FACSIMILE TRANSMISSION

DATE: 12/8/03

ORIGINAL

TO: Wesley Mueller
(NAME)

312-616-5700
(FACSIMILE NUMBER)

(ORGANIZATION)

(TELEPHONE NUMBER)

SENDER: L Bond
(NAME)

TOTAL NUMBER OF PAGES 3 (INCLUDING THIS COVER PAGE)

If you have not received all pages or you have any questions about this transmission, please contact the SPECIAL PROGRAM LAW OFFICE/OFFICE OF PETITIONS as follows:
DIRECT TELEPHONE No.: 703-305-9282 FACSIMILE No.: 703-308-6916

Brief Message:

LEYDIG, VOIT & MAYER
RECEIVED
DEC 0 9 2003
PAT/TM Doc Dept.

WOM

210030

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

LEYDIG, VOIT & MAYER
RECEIVED
DEC 0 9 2003

Paper No. 7

Leydig Voit & Mayer, LTD
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, IL 60601-6780

PATTY Due Date: 2-2-04
6-2-04 final

COPY MAILED
DEC 0 2 2003
OFFICE OF PETITIONS

In re Application of
Nanping Wu
Application No. 09/891,576
Filed: June 25, 2001
Attorney Docket No. 210030

ON PETITION

This is a decision on the petition under 37 CFR 1.137(b), filed October 29, 2003, to revive the above-identified application.

The petition is DISMISSED.

Any request for reconsideration of this decision must be submitted within TWO (2) MONTHS from the mail date of this decision. Extensions of time under 37 CFR 1.136(a) are permitted. The reconsideration request should include a cover letter entitled "Renewed Petition under 37 CFR 1.137(b)." This is not final agency action within the meaning of 5 U.S.C. 704.

A grantable petition under 37 CFR 1.137(b) must be accompanied by: (1) the required reply, unless previously filed; (2) the petition fee as set forth in 37 CFR 1.17(m); (3) a statement that the entire delay in filing the required reply from the due date for the reply until the filing of a grantable petition pursuant to 37 CFR 1.137(b) was unintentional; and (4) any terminal disclaimer (and fee as set forth in 37 CFR 1.20(d)) required by 37 CFR 1.137(c). Where there is a question as to whether either the abandonment or the delay in filing a petition under 37 CFR 1.137 was unintentional, the Commissioner may require additional information. See MPEP 711.03(c)(III)(C) and (D). The instant petition lack(s) item(s) (1).

As to item (1), There is no indication that a response to the Office action mailed July 18, 2002 has been submitted. Accordingly, a proper reply to the Office action must be submitted before revival of the application can be effected.

The required reply to a non-final action in a non-provisional application abandoned for failure to prosecute may be either: (A) an argument or an amendment under 37 CFR 1.111 or; (B) the filing of a continuing application under 37 CFR 1.53(b).

The grant of a petition under 37 CFR 1.137 is not a determination that any reply under 37 CFR 1.111 is complete. Where the proposed reply is to a non-final Office action, the petition may be granted if the reply appears to be bona fide. After revival of the application, the patent examiner may, upon more detailed review, determine that the reply is lacking in some respect. In this limited situation, the patent examiner should send out a letter giving a 1-month

LAH ARH

shortened imited situation, the patent examiner should send out a letter giving a 1-month shortened statutory period under 37 CFR 1.135(c) for correction of the error or omission. Extensions of time under 37 CFR 1.136(a) are permitted. If applicant does not correct the omission within the time period set in the letter (including any extension), the application is again abandoned. See MPEP 711.03(c).

Further correspondence with respect to this matter should be addressed as follows:

By mail: Mail Stop PETITION
Commissioner for Patents
Post Office Box 1450
Alexandria, VA 22313-1450

By hand: Crystal Plaza Four, Suite 3C23
2201 South Clark Place
Arlington, VA 22202

By Fax: (703) 308-6916
ATTN: Office of Petitions

Telephone inquiries concerning this decision should be directed the undersigned at (703) 308-6911.

Latrice Bond
Petitions Examiner
Office of Petitions
Office of the Deputy Commissioner
for Patent Examination Policy

Attachment: non-final Office action

FORM PTO-1083

PATENT
Attorney Docket No. 210030
Date: February 2, 2004

In re Application of: Nanping Wu
Application No. 09/891,576
Filed: June 25, 2001
For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Sir:

Transmitted herewith is a Response to an Office Action in the subject application.

☐ Applicants claim small entity status of this application under 37 CFR 1.27.

☐ Petition for Extension of Time
- ☐ Applicants petition for a one-month extension of time under 37 CFR 1.136, the fee for which is $110.00 (enclosed).
- ☐ Applicants believe that no petition for an extension of time is necessary. However, to the extent that such petition is deemed necessary, Applicants hereby petition for a sufficient extension of time to render the present submission timely. Please charge Deposit Account No. 12-1216 for the appropriate petition fee.

☒ No additional claim fee is required.

☒ Other: Request For Reconsideration and Renewed Petition Under 37 C.F.R. 1.137(b).

The claim fee has been calculated as shown below:

					SMALL ENTITY		OTHER THAN A SMALL ENTITY	
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	EXTRA CLAIMS PRESENT	RATE	ADDT. CLAIM FEE	RATE	ADDT. CLAIM FEE
TOTAL	§40	MINUS	40	=0	x 9=	$	x 18=	$0.00
INDEPENDENT	3	MINUS	3	=0	x 42=	$	x 84=	$0.00
☐ FIRST PRESENTATION OF MULTIPLE CLAIM					+ 140=	$	+ 280=	$
					TOTAL	$	TOTAL	$0.00

☐ Please charge my Deposit Account No. 12-1216 in the amount of $. A duplicate copy of this sheet is attached.

☐ A check in the amount of $ is attached.

☒ The Commissioner is hereby authorized to charge any deficiencies in the following fees associated with this communication or credit any overpayment to Deposit Account No. 12-1216. A duplicate copy of this sheet is attached.
- ☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.
- ☒ Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,

LEYDIG, VOIT & MAYER, LTD.

By _____
Wesley O. Mueller, Reg. No. 33,976

Leydig, Voit & Mayer, Ltd.
Two Prudential Plaza, Suite 4900
180 North Stetson
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

PATENT
Attorney Docket No. 210030
Client Reference No. 01.300P

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Nanping Wu

Application No. 09/891,576

Art Unit: 3743

Examiner: Nihir B. Patel

Filed: June 25, 2001

For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

RESPONSE TO OFFICE ACTION

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action that was originally dated July 18, 2002, please enter the following amendments and consider the following remarks.

The Listing of Claims is on pages 2-7.

The Remarks are on pages 8-11.

CERTIFICATE OF MAILING UNDER 37 CFR 1.10			
I hereby certify that this Response to Office Action and all accompanying documents are being deposited with the United States Postal Service on February 2, 2004, in an envelope as "EXPRESS MAIL POST OFFICE TO ADDRESSEE" service under 37 CFR 1.10, Mailing Label Number EV 336877243 US, addressed to: Mail Stop , Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.			
Name (Print/Type)	Margaret J. DiGrazia		
Signature	Margaret J. DiGrazia	*Date*	February 2, 2004

EV336877243US

RECEIVED
CENTRAL FAX CENTER
MAR 2 7 2007

LISTING OF CLAIMS

1. (Currently Amended) An evaporator adapted for use in a vapor-compression refrigeration cycle in a plate freezer comprising:

a longitudinally extending freezer plate body having a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to define a plate body solid volume; and

at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant flowing through the duct at a flow rate and pressure sufficient to reduce the temperature at the first and second heat transfer surfaces to a freezer operating temperature, at a level substantially below the yield strength of the material from which the plate body is constructed.

2. (Currently Amended) The invention as in claim 1 wherein the spacing between the first and second heat transfer surfaces and the dimensions of the elliptical duct are such that the von Mises stress is less than the yield strength of the material from which the [evaporator] plate body is constructed when the fluid has a pressure of approximately 1400 psig.

3. (Currently Amended) The invention as in claim 1 wherein at least one heat transfer surface contacts items to be frozen [in a plate freezer].

4. (Currently Amended) The invention as in claim 1 wherein both heat transfer surfaces contact items to be frozen [in a plate freezer].

5. (Original) The invention as in claim 1 wherein the duct extends throughout substantially the entire plate body in a serpentine manner.

6. (Original) The invention as in claim 5 wherein the plate body has a length and a width with the length substantially greater than the width and the serpentine duct extends substantially throughout the entire plate body along the length of the plate body.

7. (Original) The invention as in claim 5 wherein the serpentine duct makes seven passes through the plate body.

8. (Original) The invention as in claim 1 wherein the ratio between the total ellipse area to the total cross-sectional freezer-plate area is between about .57 and about .67.

9. (Original) The invention as in claim 1 wherein each elliptical duct has a first diameter and a second diameter with the first diameter being greater than or equal to the second diameter and the ratio between the first diameter and second diameter is between about 2.0 and about 2.35.

10. (Original) The invention as in claim 1 wherein the refrigerant passing through the evaporator is a CFC refrigerant.

11. (Original) The invention as in claim 1 wherein the refrigerant passing through the evaporator is a non-CFC refrigerant.

12. (Original) The invention as in claim 1 wherein the refrigerant passing through the evaporator is carbon dioxide.

13. (Original) The invention as in claim 1 wherein the refrigerant passing through the evaporator is ammonia.

14. (Original) The invention as in claim 1 wherein the refrigerant passing through the evaporator is at a pressure between about 100 psig and about 200 psig.

15. (Original) The invention as in claim 14 wherein the refrigerant passing through the evaporator is carbon dioxide.

16. (Currently Amended) A plate freezer comprising:

a compartment wherein the temperature of the compartment is less than or equal to approximately 0° Celsius; and

a plurality of spaced-apart shelves located in the compartment with each of the shelves adapted to receive items to be frozen between the adjacent shelves, each of the shelves include a plurality of generally rectangular plates having a length and a width with the length substantially greater than the width, the plates are disposed in an abutting relationship along their respective lengths, each plate has a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to define a plate body solid volume; and

at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant flowing through the duct at a flow rate and pressure sufficient to reduce the temperature at the first and second generally planar heat transfer surfaces to a freezer operating temperature, at a level substantially below the yield strength of the material from which the plate body is constructed.

17. (Original) The invention as in claim 16 wherein the spacing between the first and second surfaces and the dimensions of the elliptical duct are such that the von Mises stress is less than the yield strength of the material from which the plate is constructed when the refrigerant has a pressure of approximately 1400 psig.

18. (Original) The invention as in claim 16 wherein the duct extends throughout substantially the entire plate body in a serpentine manner.

19. (Original) The invention as in claim 18 wherein the serpentine duct extends substantially throughout the entire plate body along the length of the plate body.

20. (Original) The invention as in claim 18 wherein the serpentine duct makes seven passes through the plate body.

21. (Original) The invention as in claim 16 wherein the ratio between the total ellipse area to the total cross-sectional freezer-plate area is between about .57 and about .67.

22. (Original) The invention as in claim 16 wherein each elliptical duct has a first diameter and a second diameter with the first diameter being greater than or equal to the second diameter and the ratio between the first diameter and second diameter is between about 2.0 and about 2.35.

23. (Original) The invention as in claim 16 wherein the refrigerant passing through the plate is a CFC refrigerant.

24. (Original) The invention as in claim 16 wherein the refrigerant passing through the plate is a non-CFC refrigerant.

25. (Original) The invention as in claim 16 wherein the refrigerant passing through the plate is carbon dioxide.

26. (Original) The invention as in claim 16 wherein the refrigerant passing through the plate is ammonia.

27. (Original) The invention as in claim 16 wherein the refrigerant passing through the plate is at a pressure between about 100 psig and about 200 psig.

28. (Original) The invention as in claim 27 wherein the refrigerant passing through the evaporator is carbon dioxide.

29. (Currently Amended) An evaporator for a plate freezer comprising:

a plurality of spaced-apart shelves located in the compartment with each of the shelves adapted to receive items to be frozen between the adjacent shelves, each of the shelves include a plurality of generally rectangular plates having a length and a width with the length substantially greater than the width, the plates are disposed in an abutting relationship along their respective lengths, each plate has a first generally planar heat transfer surface, a second generally planar heat transfer surface spaced apart from the first heat transfer surface, to define a plate body solid volume;

at least one longitudinally extending duct passing through the plate body solid volume to channel a refrigerant maintained at a relatively high pressure, the duct having an elliptical cross-section which maintains a stress level in the plate body, caused by the relatively high pressure refrigerant flowing through the duct at a flow rate and pressure sufficient to reduce the temperature at the first and second heat transfer surfaces to a freezer operating temperature, at a level substantially below the yield strength of the material from which the plate body is constructed; and

wherein the ratio between the total ellipse area in a plate to the total cross-sectional freezer plate area of that plate is between about .57 and about .67.

30. (Original) The invention as in claim 29 wherein the spacing between the first and second heat transfer surfaces and the dimensions of the elliptical duct are such that the von Mises stress is less than the yield strength of the material from which the evaporator is constructed when the fluid has a pressure of approximately 1400 psig.

31. (Original) The invention as in claim 29 wherein the duct extends throughout substantially the entire plate body in a serpentine manner.

32. (Original) The invention as in claim 31 wherein the plate body has a length and a width with the length substantially greater than the width and the serpentine duct extends substantially throughout the entire plate body along the length of the plate body.

33. (Original) The invention as in claim 31 wherein the serpentine duct makes seven passes through the plate body.

34. (Original) The invention as in claim 29 wherein each elliptical duct has a first diameter and a second diameter with the first diameter being greater than or equal to the second diameter and the ratio between the first diameter and second diameter is between about 2.0 and about 2.35.

35. (Original) The invention as in claim 29 wherein the refrigerant passing through the evaporator is a CFC refrigerant.

36. (Original) The invention as in claim 29 wherein the refrigerant passing through the evaporator is a non-CFC refrigerant.

37. (Original) The invention as in claim 29 wherein the refrigerant passing through the evaporator is carbon dioxide.

38. (Original) The invention as in claim 29 wherein the refrigerant passing through the evaporator is ammonia.

39. (Original) The invention as in claim 29 wherein the refrigerant passing through the evaporator is at a pressure between about 100 psig and about 200 psig.

40. (Original) The invention as in claim 39 wherein the refrigerant passing through the evaporator is carbon dioxide.

RECEIVED
CENTRAL FAX CENTER
MAR 27 2007

REMARKS

Applicant submits this response to the Office Action that was originally dated on July 18, 2002, but was lost in delivery to applicant. Applicant has concurrently filed a Petition to Revive this application for unintentional abandonment thereof. Pursuant to 37 C.F.R. §1.111, applicant respectfully requests reconsideration of each and every grounds for the rejection for the claims in the outstanding Office Action.

Various claims were rejected for indefiniteness and use of certain terms therein. Applicant has amended the claims to provide better consistency and terminology of the claims, incorporating the Examiner's requested changes. Applicant respectfully submits that the claims currently presented define the invention in such particularity as would particularly point out and distinctly claim the subject matter which applicant regards as his invention. Accordingly, applicant submits that the §112, ¶2 rejections have been overcome.

The Office Action rejected claims 1, 2, 5-6, 12 and 15 under 35 U.S.C. §102(e) as being anticipated by Dienhart et al.'s U.S. Patent 6,357,522 ("Dienhart et al."). According to the Office Action, Dienhart et al. discloses a multi-channel flat tube that comprises a plate body with generally planar heat transfer surfaces wherein a duct is formed with an elliptical cross section.

Applicant notes that Dienhart et al., to the extent that the Office Action relies on a February 5, 2001 filing date for its status as prior art, may be removed as a reference upon the submission of a Rule 131 declaration. In any event, applicant respectfully submits the Dienhart et al. does not disclose the features of applicant's invention. Fundamentally, Dienhart et al. is not directed to a plate freezer or the like. Instead, Dienhart et al. relates to a tubular heat exchanger in an air conditioner for use in a motor vehicle. Apart from this fundamental distinction, Dienhart et al. does not disclose refrigerant passing through a duct at a flow rate and pressure sufficient to provides a freezer operating temperature in conformance with applicant's claims.

Similarly, applicant submits that the rejection of claim 1 as being anticipated by Kato U.S. Patent 5,768,782 ("Kato") is improper. As with Dienhart et al., Kato is deficient in several respects. Importantly, Kato discloses a flat "single plate" with depressions formed therein so that when the plate is bent (at projected portion 3), the heat exchanger is formed. Thus, Kato does not disclose a freezer plate body with planar heat transfer surfaces that define a plate body solid volume. It necessarily follows that Kato does not disclose a duct formed within the plate body solid volume.

For the same reasons, applicant respectfully traverses the Examiner's rejection of claims 2, 17 and 30 under 35 U.S.C. §103 as being obvious based on a combination of Kato and Dienhart et al. As explained above, Kato does not disclose a plate body solid volume. Instead, Kato discloses a bent flat sheet which is pressed together to form heat exchanging pathways. For this reason, it is unclear how Kato's heat exchanger could be modified by Dienhart et al. to provide applicant's invention, as suggested in the Office Action. Indeed, it is likely that Kato's opposed sheets would come apart from each other if modified as suggested in the Office Action.

Moreover, applicant submits that the references cited by the Office Action in rejecting the claims for obviousness are not "analogous" prior art. *See In re Clay*, 966 F.2d. 656 (Fed. Cir. 1992). The question of whether a prior art reference is analogous involves the determination of two criteria: (1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved. *See In re Clay,* 966 F.2d at 658-59. In this instance, the subject matter of the claims is directed to the plate freezer art. The mere fact that the references cited by the Examiner generally relate to heat exchangers, intended for use in other applications such as for automobile air conditioners (Dienhart et al., Matsuo et al.), tractor trailers (Johnson et al.), air dryers (Dowling), and kimchi jars (Seol), is inapposite.

Apart from this distinction, unlike the problems addressed in the references cited by the Examiner, the problem addressed by applicant is that of providing a thermo-dynamically suitable refrigerant that may be used in a plate freezer without destroying the environment. (*See* specification at p. 2, ll. 9-28.) The specification further indicates that there are inherent difficulties in operating a carbon dioxide refrigerant such that it may withstand the stress levels and the like found at higher pressures, such as in the case of "shutdown" or the like of the freezer (see p. 3, ll. 5-19), particularly when heat exchanger materials such as aluminum are utilized. Accordingly, the obviousness rejections should be reconsidered and withdrawn for this reason.

Apart from the non-analogousness of the cited art, the rejection of claims 3 and 4 as obvious based on Dienhart et al. or Kato further in view of Perryment et al. U.S. Patent 5,860,471, is likewise improper. Perryment et al. discloses a conventional heat exchange device for use in a plate freezer. It does not add the missing features of claims 3 and 4, even if it were somehow combined with Dienhart et al. and/or Kato. Moreover, there is no reason or suggestion to do so inasmuch as Dienhart et al. and Kato do not relate to the plate freezer art.

Applicant respectfully traverses the rejection of claims 5, 6, 18, 19, 31 and 32 as obvious based on the combination of Kato in view of Matsuo et al. U.S. Patent 5,927,102. As noted above, Matsuo et al. discloses a condenser for use in an air conditioner in a motor vehicle. It is unclear how Matsuo et al. could be used to modify Kato to include the missing elements, such as a solid plate volume with a duct extending therethrough in a serpentine manner, as proposed in the Office Action. Instead, the modified Kato arrangement would, at most, be formed from a bent sheet. Thus, it appears as though the Office Action is using the teachings of applicant's disclosure in order to provide missing elements, such as a duct formed "in a serpentine manner in order to get a smoother flow."

Similarly, the rejection of claims 5, 19 and 32 based on Kato further in view of Matsuo et al. is likewise inappropriate. As explained above, Kato is a bent plate heat exchanger, not a solid volume. In any event, Kato may not properly be combined with Matsuo et al. to provide such a serpentine arrangement and as claimed by applicant. Among other reasons, there would be no motivation to so combine these references and it is unclear how the plate in Kato could be so modified.

The Office Action rejected claims 7, 20 and 33 as simply a matter of design choice with respect to the number of passes of the serpentine duct through the plate body. As apparently conceded by the Office Action, no prior art reference suggests or discloses each of the recited elements. Accordingly, applicant requests reconsideration of the rejection and allowance of these claims.

The same comments also apply to claims 8, 21 and 29 which further recite a ratio between the total ellipse area and the total cross-sectional freezer-plate area as being between about .57 and about .67. As explained in the applicant's disclosure, utilizing such a ratio is not simply a matter of design choice but should be accorded patentability.

Claims 9, 22 and 34, as noted in the Office Action, state further specific ratios between the first diameter and the second diameter. Again, the specification explains why such diameters provide improved results which are not found in the prior art relied on by the Examiner. Accordingly, these claims are allowable for these additional reasons.

The Office Action rejected claims 10, 12, 15, 23, 25, 28, 35, 37 and 40 under 35 U.S.C. §103(a) as being obvious based on a combination of Kato in view of Johnson et al. U.S. Patent 5,320,167 ("Johnson et al."). The Office Action concludes that Kato fails to disclose that the refrigerant passing through the evaporator is a CFC refrigerant or carbon dioxide. While Johnson et al. discloses an air conditioning and refrigerant system using a cryogen, it is intended for use in a tractor trailer. Applicant submits that it would not be obvious to merely use that teaching in Kato's arrangement, particularly in view of the fact that

Kato forms a heat exchanger by bending a formed plate together, to render these claims obvious.

The same observations apply to the Office Action's rejection of claims 11, 13, 24, 26, 36 and 38. According to the Office Action, these claims are obvious based on Kato in view of Gilley et al. U.S. Patent 5,737,923 ("Gilley et al."). However, Gilley et al. is directed to a thermoelectric device which appears to be an entirely different application as compared to Kato. In any event, neither reference discloses or renders obvious the subject matter of applicant's claims 11, 13, 24, 25, 36 and 38.

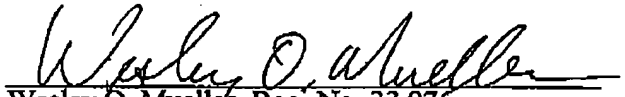
Claims 14, 27 and 39 were rejected as being obvious in view of Kato in view of Dowling U.S. Patent 4,235,081 ("Dowling"). As noted in the Office Action, Dowling is directed to a compressed air dryer. The deficiencies in Kato have been described above. For those reasons, claims 14, 27 and 39 are allowable.

Claim 16 was rejected as obvious based on Kato in view of Seol U.S. Patent 6,006,533 ("Seol"). As noted in the Office Action, Kato does not disclose that the temperature within the compartment is less than or equal to 0° degrees Celsius. As with the above rejections, the Office Action appears to have merely picked and chosen selected teachings in Seol, and combined them with Kato to fill missing gaps in these references. Applicant thus requests reconsideration and withdrawal of the rejection of claim 16.

Conclusion

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



Wesley O. Mueller, Reg. No. 33,976
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

Date: February 2, 2004

RECEIVED
CENTRAL FAX CENTER

MAR 2 7 2007

PATENT
Attorney Docket No. 210030
Client Reference No. 01.300P

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Nanping Wu

Application No. 09/891,576

Art Unit: 3743

Examiner: Nihir B. Patel

Filed: June 25, 2001

For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

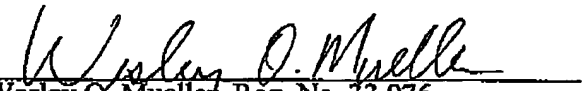
REQUEST FOR RECONSIDERATION AND RENEWED PETITION UNDER 37 C.F.R. §1.137(b)

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Decision On Petition Under 37 C.F.R. 1.137(b) mailed on December 2, 2003 (Paper No. 7), applicant submits the attached Reply Under 37 C.F.R. §1.111. Applicant respectfully requests that the dismissal be withdrawn and the Petition be granted.

Respectfully submitted,



Wesley O. Mueller, Reg. No. 33,976
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

Date: February 2, 2004

In re Appln. of Nanping Wu
Application No. 09/891,576

CERTIFICATE OF MAILING UNDER 37 CFR 1.10			
I hereby certify that this REQUEST FOR RECONSIDERATION AND RENEWED PETITION UNDER 37 C.F.R. §1.137(b) and all accompanying documents are being deposited with the United States Postal Service on February 2, 2004, in an envelope as "EXPRESS MAIL POST OFFICE TO ADDRESSEE" service under 37 CFR 1.10, Mailing Label Number EV 336877243 US, addressed to: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.			
Name (Print/Type)	Margaret J. DiGrazia		
Signature	Margaret J. DiGrazia	*Date*	February 2, 2004

Customer Copy
Label 11-F June 2002

EXPRESS MAIL
UNITED STATES POSTAL SERVICE
Post Office To Addressee

EV 336677243 US

ORIGIN (POSTAL USE ONLY)

PO ZIP Code 60611
Day of Delivery: Next / Second
Flat Rate Envelope
Date In: Mo. 3 Day 23 Year 04
12 Noon / 3 PM
Postage $
Time In 5:40 AM / PM
Military: 2nd Day / 3rd Day
Return Receipt Fee
Weight 2 lbs. ozs.
Int'l Alpha Country Code
COD Fee
Insurance Fee
No Delivery: Weekend / Holiday
Acceptance Clerk Initials
Total Postage & Fees $

DELIVERY (POSTAL USE ONLY)

Delivery Attempt Mo. Day — Time AM / PM — Employee Signature
Delivery Attempt Mo. Day — Time AM / PM — Employee Signature
Delivery Date Mo. Day — Time AM / PM — Employee Signature

WAIVER OF SIGNATURE (Domestic Only) Additional merchandise insurance is void if waiver of signature is requested. I wish delivery to be made without obtaining signature of addressee or addressee's agent (if delivery employee judges that article can be left in secure location) and I authorize that delivery employee's signature constitutes valid proof of delivery.
NO DELIVERY Weekend Holiday
Customer Signature

CUSTOMER USE ONLY
METHOD OF PAYMENT:
Express Mail Corporate Acct. No.
Federal Agency Acct. No. or Postal Service Acct. No.

FROM: (PLEASE PRINT) PHONE 312 616 5600

LEYDIG VOIT MAYER
180 N STETSON AVE STE 4900
2 PRUDENTIAL PLAZA
CHICAGO IL 60601-6745
Attention: Wesley O. Mueller

Docket 210030

TO: (PLEASE PRINT) PHONE

MS Petition
COMMISSIONER FOR PATENTS
PO BOX 1450
ALEXANDRIA VA 22313-1450

PRESS HARD.
You are making 3 copies.

FOR PICKUP OR TRACKING CALL 1-800-222-1811 www.usps.com

THE PATENT AND TRADEMARK OFFICE IS RESPECTFULLY REQUESTED TO PLACE ITS STAMP ON THIS POSTAL CARD AND PLACE IT IN THE OUTGOING MAIL TO SHOW THE FOLLOWING PAPERS HAVE BEEN RECEIVED.

In re Nanping Wu U.S. Serial No. 09/891,576
For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

Items:
1. **Response to Office Action with Certificate of Mailing (11 pgs.)**
2. **Request For Reconsideration And Renewed Petition Under 37 C.F.R. 1.137(b) with Certificate of Mailing (2 pgs.)**
3. **Form PTO-1083 (1 pg. in duplicate)**
4. **Express Mailing Label EV 336877243 US**

Date Mailed via Express Mail: February 2, 2004
Due Date: February 2, 2004
Attorney Docket: 210030
WOM/mjd

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Paper No. 10

Noted

COPY MAILED

FEB 0 6 2004

OFFICE OF PETITIONS

Leydig Voit & Mayer, Ltd.
Two Prudential Plaza, Suite 4900
180 North Stetson
Chicago, IL 60601-6780

In re Application of
Nanping Wu
Application No. 09/891,576
Filed: June 25, 2001
Attorney Docket No. 210030

ON PETITION

This is a decision in reply to the renewed petition under 37 CFR 1.137(b), filed February 2, 2004, to revive the above-identified application.

The petition is granted.

The above-identified application became abandoned for failure to reply in a timely manner in reply to the non-final Office action mailed July 18, 2002, which set a shortened statutory period for reply of three months. No extensions of time under the provisions of 37 CFR 1.136 have been obtained. Accordingly, the application became abandoned on October 19, 2002.

The application will be forwarded to Technology Center AU 3743 for further processing.

Telephone inquiries concerning this decision should be directed to Latrice Bond at (703) 308-6911.

Latrice Bond
Petitions Examiner
Office of Petitions
Office of the Deputy Commissioner
for Patent Examination Policy

ARP

PATENT
Attorney Docket No. 210030
Client Reference No. 01.300P

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Nanping Wu

Application No. 09/891,576

Art Unit: 3743

Examiner: Nihir B. Patel

Filed: June 25, 2001

For: Plate Freezer Evaporator With Carbon Dioxide Refrigerant

STATUS INQUIRY

Mail Stop
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

More than 12 months have passed since the Request For Reconsideration and New Petition Under 37 C.F.R. 1.137(b) was granted (see attached).

It would be appreciated if you could kindly advise the undersigned attorney of the present status of this application by checking the appropriate box on the attached page, which then can be returned to the undersigned attorney.

Respectfully submitted,

Wesley O. Mueller, Registration No. 33,976
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6780
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

Date: September 7, 2005
Attachment

In re Appln. of Nanping Wu
Application No. 09/891,576

CERTIFICATE OF MAILING/TRANSMISSION (37 CFR 1.8a)

I hereby certify that this correspondence, on the date shown below, is being:

☐ deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to Mail Stop , Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

☒ transmitted by facsimile to the Patent and Trademark Office.

Date: September 7, 2005

Margaret J. DiGrazia
Signature

MARGARET J. DiGRAZIA
Printed Name

STATUS_INQUIRY (Rev. 2/13/04)

RECEIVED
CENTRAL FAX CENTER
MAR 2 7 2007

In re Appln. of Nanping Wu
Application No. 09/891,576

STATUS INQUIRY REPLY

Application No. 09/891,576 is currently:

☐ Assigned to Group _____ and awaits:

☐ action by the Examiner.

☐ applicant's response to the Office Action mailed _____.

☐ Scheduled to issue as U.S. Patent _____ on _____

☐ Other:

_____

Appeal No.

☐ is awaiting action by the Board of Patent Appeals and Interferences

☐ date of hearing expected _____.

☐ decision expected _____.

* * * COMMUNICATION RESULT REPORT (SEP. 7. 2005 10:11AM) * * *

TTI LVM 312 616 5700

TRANSMITTED/STORED SEP. 7. 2005 10:10AM FILE MODE	OPTION	ADDRESS	RESULT	PAGE
6201 MEMORY TX		G3-AT:8210030915712738300	OK	5/5

RECEIVED
CENTRAL FAX CENTER

MAR 2 7 2007

REASON FOR ERROR
E-1) HANG UP OR LINE FAIL
E-2) BUSY
E-3) NO ANSWER
E-4) NO FACSIMILE CONNECTION

LAW OFFICES
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza Suite 4900
Chicago, Illinois 60601-6780

Telephone: (312) 616-5600 Facsimile: (312) 616-5700

FAX COVER SHEET

Date: September 7, 2005

Number of pages (including this transmittal cover sheet): 5

Our Reference: 210030

To: **ATTENTION: EXAMINER Nihir B. Patel – Group 3743**
U.S. PATENT AND TRADEMARK OFFICE
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

TELEPHONE: 571-272-4803
FACSIMILE: 571-273-8300

From: Wesley O. Mueller, Esq. Direct Dial: 312-616-5643

MESSAGE: